

WSR 11-18-086
EXPEDITED RULES
BUILDING CODE COUNCIL

[Filed September 7, 2011, 8:51 a.m.]

Title of Rule and Other Identifying Information: Chapter 51-11 WAC, 2009 Washington State Energy Code.

NOTICE

THIS RULE IS BEING PROPOSED UNDER AN EXPEDITED RULE-MAKING PROCESS THAT WILL ELIMINATE THE NEED FOR THE AGENCY TO HOLD PUBLIC HEARINGS, PREPARE A SMALL BUSINESS ECONOMIC IMPACT STATEMENT, OR PROVIDE RESPONSES TO THE CRITERIA FOR A SIGNIFICANT LEGISLATIVE RULE. IF YOU OBJECT TO THIS USE OF THE EXPEDITED RULE-MAKING PROCESS, YOU MUST EXPRESS YOUR OBJECTIONS IN WRITING AND THEY MUST BE SENT TO Tim Nogler, Managing Director, Washington State Building Code Council, P.O. Box 41449, Olympia, WA 98504-1449, AND RECEIVED BY November 10, 2011.

Purpose of the Proposal and Its Anticipated Effects, Including Any Changes in Existing Rules: WAC 51-11-0503, in Section 503.8.1, redundant language was added to the end of the second paragraph. The requirement for a second seven day programmable thermostat is stricken. (OTS 4110.1)

WAC 51-11-0900, in Section 901, Chapter 6 was added to the charging language to clarify that the use of Chapter 6 for base compliance is allowed. (OTS 4111.1)

WAC 51-11-1412, Section 1412.4 was amended to provide clarity on the requirements applicable to multi-family residential buildings. (OTS 4112.1)

WAC 51-11-1436, a typographical error in Section 1436.2 was corrected. (OTS 4109.1)

Reasons Supporting Proposal: Some editorial errors were identified in the rules filed under WSR 10-03-115. This rule corrects those errors.

Statutory Authority for Adoption: RCW 19.27A.025, 19.27A.045.

Statute Being Implemented: Chapters 19.27, 19.27A, and 34.05 RCW.

Rule is not necessitated by federal law, federal or state court decision.

Name of Proponent: State building code council, governmental.

Name of Agency Personnel Responsible for Drafting and Implementation: Krista Braaksma, P.O. Box 41449, Olympia, WA 98504-1449, (360) 407-9278; and Enforcement: Local jurisdictions.

September 6, 2011

Kristyn Clayton
Council Chair

AMENDATORY SECTION (Amending WSR 10-03-115, 10-13-113 and 10-22-056, filed 1/20/10, 6/21/10 and 10/28/10, effective 1/1/11)

WAC 51-11-0503 Mechanical systems.

503.1 General: This section covers the determination of design requirements, system and component performance, control requirements, insulating systems and duct sealing. For all other duct construction requirements, refer to the State Mechanical Code (chapter 51-52 WAC).

503.2 Calculations of Heating and Cooling Loads, and System Sizing Limits: The design parameters specified in Chapter 3 shall apply for all computations.

503.2.1 Calculation Procedures: Heating and cooling design loads for the purpose of sizing HVAC systems are required and shall be calculated in accordance with accepted engineering practice, including infiltration and ventilation.

503.2.2 Space Heating and Space Cooling System Sizing Limits: Mechanical systems for all buildings which provide space heating and/or space cooling shall be sized as required in IRC Section M1401.3.

EXCEPTIONS: The following limited exemptions from the sizing limit shall be allowed; however, in all cases heating and/or cooling design load calculations shall be submitted.

1. For equipment which provides both heating and cooling in one package unit, including heat pumps with electric heating and cooling and gas-pack units with gas heating and electric cooling, compliance need only be demonstrated for the larger of the space heating or space cooling load for the selected system size.

2. Natural gas- or oil-fired space heating equipment whose total rated space heating output in any one dwelling unit is 40,000 Btu/h or less is exempt from the sizing limit.

3. Stand-by equipment may be installed if controls and other devices are provided which allow redundant equipment to operate only when the primary equipment is not operating.

4. Electric resistance heaters under 2 kW.

503.3 Simultaneous Heating and Cooling: Systems and equipment that provide simultaneous heating and cooling shall comply with the requirements in, as appropriate, Section 1422 or Section 1435.

503.4 HVAC Equipment Performance Requirements: All heating equipment shall meet the requirements of the National Appliance Energy Conservation Act (NAECA) and be so labeled. Equipment shall also comply with Section 1411.

503.5 Reserved.

503.6 Balancing: The HVAC system design shall provide a means for balancing air and water systems. Balancing the system shall include, but not be limited to, dampers, temperature and pressure test connections and balancing valves.

503.7 Cooling with Outdoor Air (Economizer Cycle): Systems and equipment that provide mechanical cooling shall comply with Section 1413 and, as appropriate, Section 1423 or 1433.

503.8 Controls:

503.8.1 Temperature Control: The primary space conditioning system within each dwelling unit shall be provided with at least one programmable thermostat for the regulation

of temperature. The thermostat shall allow for, at a minimum, a 5-2 programmable schedule (weekdays/weekends) and be capable of providing at least two programmable setback periods per day.

Each additional system provided within a dwelling unit shall be provided with at least one adjustable thermostat for the regulation of temperature. ~~((The thermostat shall allow for, at a minimum, a 5-2 programmable scheduled (weekdays/weekends).))~~

EXCEPTIONS:

1. Systems controlled by an occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to thirty minutes.
2. Systems controlled solely by a manually operated timer capable of operating the system for no more than two hours.

Each thermostat shall be capable of being set by adjustment or selection of sensors as follows:

503.8.1.1: When used to control heating only: Fifty-five degrees to seventy-five degrees F.

503.8.1.2: When used to control cooling only: Seventy degrees to eighty-five degrees F.

503.8.1.3: When used to control both heating and cooling, it shall be capable of being set from fifty-five degrees to eighty-five degrees F and shall be capable of operating the system heating and cooling in sequence. The thermostat and/or control system shall have an adjustable deadband of not less than ten degrees F.

503.8.2 Humidity Control: If a system is equipped with a means for adding moisture to maintain specific selected relative humidities in space or zones, a humidistat shall be provided. Humidistats shall be capable of being set to prevent new energy from being used to produce space-relative humidity above thirty percent.

EXCEPTION: Special uses requiring different relative humidities may be permitted when approved by the building official.

503.8.3 Zoning for Temperature Control:

503.8.3.1 One- and Two-Family Dwellings: At least one thermostat for regulation of space temperature shall be provided for each separate system. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each zone or floor.

503.8.3.2 Multifamily Dwellings: For multifamily dwellings, each individual dwelling unit shall have at least one thermostat for regulation of space temperature. A readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each room. Spaces other than living units shall meet the requirements of 503.8.3.3.

503.8.3.3 Control Setback and Shutoff:

One- and Two-Family and Individual Multifamily dwelling units—The thermostat required in section 503.8.3.1 or section 503.8.3.2, or an alternate means such as a switch or clock, shall provide a readily accessible, manual or automatic means for reducing the energy required for heating and cool-

ing during the periods of nonuse or reduced need, such as, but not limited to unoccupied periods and sleeping hours. Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

503.8.3.4 Systems Serving Multiple Dwelling Units, Guest Rooms, and Common Areas: Systems that serve more than two dwelling units, guest rooms, and common areas shall comply with the control requirements in Sections 1412 and 1432, with the exceptions of Sections 1412.4.2 and 1432.1.

503.8.3.5 Heat Pump Controls: Heat pumps with supplementary electric resistance heaters shall have controls complying with Section 503.8.1. In addition, controls shall meet the following requirements:

1. Prevent supplementary heater operation when the heating load can be met by the heat pump alone; and

2. The cut-on temperature for compression heating shall be higher than the cut-on temperature for supplementary heating, and the cut-off temperature for compressing heating shall be higher than the cut-off temperature for supplementary heating.

All heat pumps installed under this section shall include the capability to lock out the supplementary heat based on outdoor temperature. This control shall have a maximum setting of 40°F. At final inspection, the lock out control shall be set to 32°F or less.

EXCEPTION: The controls may allow supplementary heater operation during defrost.

503.9 Air Handling Duct System Insulation: Ducts, plenums and enclosures installed in or on buildings shall be thermally insulated per Table 5-11.

EXCEPTIONS: Duct insulation (except where required to prevent condensation) is not required in any of the following cases:

1. When the heat gain or loss of the ducts, without insulation, will not increase the energy requirements of the building.
2. Within the HVAC equipment.
3. Exhaust air ducts.
4. Supply or return air ducts installed in basements or cellars in one-and two-family dwellings.
5. The insulation required on supply air ducts may be reduced to R-4 when installed in buffer spaces not intended for human occupancy such as insulation crawl spaces and enclosed attic spaces. The buffer space must be air sealed and insulated to the full value of conditioned spaces.

503.10 Ducts.

503.10.1 Installation of ducts in exterior walls, floors or ceilings shall not displace required envelope insulation. Building cavities may not be used as ducts.

503.10.2 Leakage Testing: Ducts shall be leak tested in accordance with RS-33, using the maximum duct leakage rates specified in Section 503.10.3.

503.10.3 Sealing: All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and

seams shall comply with Section M1601.3 of the International Residential Code or Section 603.9 of the International Mechanical Code. Duct tightness testing shall be conducted to verify that the ducts are sealed. A signed affidavit documenting the test results shall be provided to the jurisdiction having authority by the testing agent. When required by the building official, the test shall be conducted in the presence of department staff. Duct tightness shall be verified by either of the following:

1. Postconstruction test: Leakage to outdoors shall be less than or equal to 6 cfm per 100 ft² of conditioned floor area or a total leakage less than or equal to 8 cfm per 100 ft² of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to 6 cfm per 100 ft² of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed-in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm per 100 ft² of conditioned floor area.

EXCEPTIONS:

1. Duct tightness test is not required if the air handler and all ducts are located within conditioned space.
2. Duct tightness test is not required if the furnace is a nondirect vent type combustion appliance installed in an unconditioned space. A maximum of six feet of connected ductwork in the unconditioned space is allowed. All additional supply and return ducts shall be within the conditioned space. Ducts outside the conditioned space shall be sealed with a mastic type duct sealant and insulated on the exterior with R-8 insulation for above grade ducts and R-5 water resistant insulation when within a slab or earth.

503.10.4 Dampers: Requirements for Automatic or manual dampers are found in Chapter 15 of the Washington State Residential Code (chapter 51-51 WAC).

503.11 Pipe Insulation: All piping shall be thermally insulated in accordance with Table 5-12.

EXCEPTION: Piping installed within unitary HVAC equipment.

Cold water pipes outside the conditioned space shall be insulated in accordance with the Washington State Plumbing Code (chapter 51-56 WAC).

AMENDATORY SECTION (Amending WSR 10-22-057, filed 10/28/10, effective 1/1/11)

WAC 51-11-0900 Chapter 0900—Additional residential energy efficiency requirements.

901 Additional Residential Energy Efficiency Requirements. Dwelling units permitted under this Code shall comply with all provisions of Chapter 5 or Chapter 6 of this Code and develop 1 credit from Table 9-1.

EXCEPTION: Buildings complying using Chapter 4 Building Design by Systems Analysis shall meet this provision of this section by demonstrating that the proposed

building energy use is 8 percent less than the target building energy use.

**TABLE 9-1
ENERGY CREDITS (DEBITS)**

OPTION	DESCRIPTION	CREDIT(S)
1a	HIGH EFFICIENCY HVAC EQUIPMENT 1: Gas, propane or oil-fired furnace or boiler with minimum AFUE of 92%, or Air-source heat pump with minimum HSPF of 8.5.	1.0
1b	HIGH EFFICIENCY HVAC EQUIPMENT 2: Closed-loop ground source heat pump; with a minimum COP of 3.3.	2.0
1c	HIGH EFFICIENCY HVAC EQUIPMENT 3: DUCTLESS SPLIT SYSTEM HEAT PUMPS, ZONAL CONTROL: In home where the primary space heating system is zonal electric heating, a ductless heat pump system shall be installed and provide heating to at least one zone of the housing unit.	1.0
2	HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM. ¹ All heating and cooling system components installed inside the conditioned space. All combustion equipment shall be direct vent or sealed combustion. Locating system components in conditioned crawl spaces is not permitted under this option. Electric resistance heat is not permitted under this option. Direct combustion heating equipment with AFUE less than 80% is not permitted under this option.	1.0
3a	EFFICIENT BUILDING ENVELOPE 1: Prescriptive compliance is based on Table 6-1, Option III with the following modifications: Window U = 0.28 floor R-38, slab on grade R-10 full, below grade slab R-10 full. or	0.5

OPTION	DESCRIPTION	CREDIT(S)	OPTION	DESCRIPTION	CREDIT(S)
3b	<p>Component performance compliance: Reduce the Target UA from Table 5-1 by 5%, as determined using EQUATION 1.</p> <p>EFFICIENT BUILDING ENVELOPE 2:</p> <p>Prescriptive compliance is based on Table 6-1, Option III with the following modifications: Window U = 0.25 and wall R-21 plus R-4 and R-38 floor, slab on grade R-10 full, below grade slab R-10 full, and R-21 plus R-5 below grade basement walls.</p> <p>or</p> <p>Component performance compliance: Reduce the Target UA from Table 5.1 by 15%, as determined using EQUATION 1.</p>	1.0	4b	<p>utilities, plumbing, electrical, ventilation, and combustion appliances.</p> <p>and</p> <p>All whole house ventilation requirements as determined by Section M1508 of the Washington State Residential Code shall be met with a heat recovery ventilation system in accordance with Section M1508.7 of that Code.</p> <p>ADDITIONAL AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION:</p> <p>Envelope leakage reduced to SLA of 0.00015 building envelope tightness shall be considered acceptable when tested air leakage is less than specific leakage area of 0.00015 when tested with a blower door at a pressure difference of 50 PA. Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances.</p> <p>and</p> <p>All whole house ventilation requirements as determined by Section M1508 of the Washington State Residential Code shall be met with a heat recovery ventilation system in accordance with Section M1508.7 of that Code.</p>	1.0
3c	<p>SUPER-EFFICIENT BUILDING ENVELOPE 3:</p> <p>Prescriptive compliance is based on Table 6-1, Option III with the following modifications:</p> <p>Window U = 0.22 and wall R-21 plus R-12 and R-38 floor, slab on grade R-10 full, below grade slab R-10 full and R-21 plus R-12 below grade basement walls and R-49 advanced ceiling and vault.</p> <p>or</p> <p>Component performance compliance: Reduce the Target UA from Table 5.1 by 30%, as determined using EQUATION 1.</p>	2.0	5a	<p>EFFICIENT WATER HEATING:</p> <p>Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.62.</p> <p>or</p> <p>Electric Water Heater with a minimum EF of 0.93.</p> <p>and for both cases</p> <p>All showerhead and kitchen sink faucets installed in the house shall meet be rated at 1.75 GPM or less. All other lavatory faucets shall be rated at 1.0 GPM or less.²</p>	0.5
4a	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION:</p> <p>Envelope leakage reduced to SLA of 0.00020 building envelope tightness shall be considered acceptable when tested air leakage is less than specific leakage area of 0.00020 when tested with a blower door at a pressure difference of 50 PA. Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for</p>	0.5			

OPTION	DESCRIPTION	CREDIT(S)	OPTION	DESCRIPTION	CREDIT(S)
5b	HIGH EFFICIENCY WATER HEATING: Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.82. or Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems. or Electric heat pump water heater with a minimum EF of 2.0.	1.5		The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower.	
			Footnotes:	1. Interior Duct Placement: Ducts included as Option 2 of Table 9-1 shall be placed wholly within the heated envelope of the housing unit. The placement shall be inspected and certified to receive the credits associated with this option.	
			EXCEPTION:	Ducts complying with this section may have up to 5% of the total linear feet of ducts located in the exterior cavities or buffer spaces of the dwelling. If this exception is used the ducts will be tested to the following standards: Post-construction test: Leakage to outdoors shall be less than or equal to 1 CFM per 100 ft ² of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. 2. Plumbing Fixtures Flow Ratings. Low flow plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following requirements: (a) Residential bathroom lavatory sink faucets: Maximum flow rate - 3.8 L/min (1.0 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1. (b) Residential kitchen faucets: Maximum flow rate - 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1. (c) Residential showerheads: Maximum flow rate - 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.	
6	SMALL DWELLING UNIT 1: Dwelling units less than 1500 square feet in floor area with less than 300 square feet of window + door area. Additions to existing building that are less than 750 square feet of heated floor area.	1.0			
7	LARGE DWELLING UNIT 1: Dwelling units exceeding 5000 square feet of floor area shall be assessed a deduction for purposes of complying with Section 901 of this Code.	-1.0			
8	RENEWABLE ELECTRIC ENERGY: For each 1200 kWh of electrical generation provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows: For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTS. Documentation noting solar access shall be included on the plans. For wind generation projects designs shall document annual power generation based on the following factors:	[0.5]			
				Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency and appear in the Register pursuant to the requirements of RCW 34.08.040.	
				AMENDATORY SECTION (Amending WSR 10-03-115, 10-13-113 and 10-22-056, filed 1/20/10, 6/21/10 and 10/28/10, effective 1/1/11)	
				WAC 51-11-1412 Controls.	
				1412.1 Temperature Controls: Each system shall be provided with at least one temperature control device. Each zone shall be controlled by individual thermostatic controls responding to temperature within the zone. At a minimum, each floor of a building shall be considered as a separate zone. Controls on systems required to have economizers and serving single zones shall have multiple cooling stage capability and that activate the economizer when appropriate as the first stage of cooling. See Section 1423 or 1433 for further economizer control requirements.	
				1412.2 Deadband Controls: When used to control both comfort heating and cooling, zone thermostatic controls shall be capable of a deadband of at least 5 degrees F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.	
			EXCEPTIONS:	1. Special occupancy, special usage, or code requirements where deadband controls are not appropriate. 2. Thermostats that require manual changeover between heating and cooling modes.	

1412.3 Humidity Controls: If a system is equipped with a means for adding moisture, a humidistat shall be provided.

1412.4 Setback and Shutoff: For all occupancies other than Group R, HVAC systems shall be equipped with automatic controls capable of accomplishing a reduction of energy use through control setback or equipment shutdown during periods of nonuse or alternate use of the spaces served by the system. The automatic controls shall:

- a. Have a minimum seven-day clock and be capable of being set for seven different day types per week,
- b. Be capable of retaining programming and time setting during loss of power for a period of at least ten hours, and
- c. Include an accessible manual override, or equivalent function (e.g., telephone interface), that allows temporary operation of the system for up to two hours.

EXCEPTIONS:

1. Systems serving areas which require continuous operation at the same temperature setpoint.
2. Equipment with full load demands of 2 Kw (6,826 Btu/h) or less may be controlled by readily accessible manual off-hour controls.
3. Systems controlled by an occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
4. Systems controlled solely by a manually operated timer capable of operating the system for no more than two hours.

For Group R-1 hotel and motel guest rooms, a minimum of one of the following control technologies shall be required in hotels/motels with over 50 guest rooms such that the space temperature would automatically setback (winter) or set up (summer) by no less than 3°C (5°F) when the occupant is not in the room:

1. Controls that are activated by the room occupant via the primary room access method - key, card, deadbolt, etc.
2. Occupancy sensor controls that are activated by the occupant's presence in the room.

For Group R-2 and R-3 dwelling units, the primary space conditioning system within each dwelling unit shall be provided with at least one programmable thermostat for the regulation of temperature. The thermostat shall allow for, at a minimum, a 5-2 programmable schedule (weekdays/weekends) and be capable of providing at least two programmable setback periods per day.

Each additional system provided within a dwelling unit shall be provided with at least one adjustable thermostat for the regulation of temperature.

EXCEPTIONS:

1. Systems controlled by an occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
2. Systems controlled solely by a manually operated timer capable of operating the system for no more than two hours.

Each thermostat shall be capable of being set by adjustment or selection of sensors as follows:

When used to control heating only: 55°F to 75°F.

When used to control cooling only: 70°F to 85°F.

1412.4.1 Dampers: Outside air intakes, exhaust outlets and relief outlets serving conditioned spaces shall be equipped with motorized dampers which close automatically when the

system is off or upon power failure. Return air dampers shall be equipped with motorized dampers. Stair shaft and elevator shaft smoke relief openings shall be equipped with normally open (fails to open upon loss of power) dampers. These dampers shall remain closed until activated by the fire alarm system or other approved smoke detection system.

EXCEPTIONS:

1. Systems serving areas which require continuous operation.
2. Combustion air intakes.
3. Gravity (nonmotorized) relief dampers are acceptable in equipment with less than 5,000 cfm total supply flow when in buildings less than 3 stories in height.
4. Type 1 grease hoods exhaust.
5. In Group R occupancies dampers shall comply with the requirements of the State Mechanical Code (chapter 51-52 WAC).

Dampers installed to comply with this section, including dampers integral to HVAC equipment, shall have a maximum leakage rate when tested in accordance with AMCA Standard 500 of:

(a) Motorized dampers: 10 cfm/ft² of damper area at 1.0 in w.g.

(b) Nonmotorized dampers: 20 cfm/ft² of damper area at 1.0 in w.g., except that for nonmotorized dampers smaller than 24 inches in either dimension: 40 cfm/ft² of damper area at 1.0 in w.g.

Drawings shall indicate compliance with this section.

1412.4.1.1 Damper Controls: Dampers for outdoor air supply and exhaust shall automatically shut when the systems or spaces served are not in use or during building warm-up, cooldown, and setback. Operation of dampers shall be allowed during ventilation prepurge one hour before expected occupancy and for unoccupied period precooling during the cooling season.

Classrooms, gyms, auditoriums and conference rooms larger than 500 square feet of floor area shall have occupancy sensor control that will either close outside air dampers or turn off serving equipment when the space is unoccupied except where equipped with another means to automatically reduce outside air intake below design rates when spaces are partially occupied.

1412.4.2 Optimum Start Controls: Heating and cooling systems with design supply air capacities exceeding 2,000 cfm shall have optimum start controls. Optimum start controls shall be designed to automatically adjust the start time of an HVAC system each day to bring the space to desired occupied temperature levels immediately before scheduled occupancy. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint and the amount of time prior to scheduled occupancy.

1412.5 Heat Pump Controls: Unitary air cooled heat pumps shall include microprocessor controls that minimize supplemental heat usage during start up, set-up, and defrost conditions. These controls shall anticipate need for heat and use compression heating as the first stage of heat. Controls shall indicate when supplemental heating is being used through visual means (e.g., LED indicators). Heat pumps equipped

with supplementary heaters shall be installed with controls that prevent supplemental heater operation above 40°F.

1412.6 Combustion Heating Equipment Controls: Combustion heating equipment with a capacity over 225,000 Btu/h shall have modulating or staged combustion control.

EXCEPTIONS: Boilers.
Radiant heaters.

1412.7 Balancing: Each air supply outlet or air or water terminal device shall have a means for balancing, including but not limited to, dampers, temperature and pressure test connections and balancing valves.

1412.8 Ventilation Controls for High-Occupancy Areas. Demand control ventilation (DCV) is required for spaces that are larger than 500 ft², have an occupant density for ventilation of greater than 25 people per 1000 ft² of floor area (based on the Default Occupant Density column of Table 403.3 of the Washington State Mechanical Code), and are served by systems with one or more of the following:

- a. An air-side economizer,
- b. Automatic modulating control of the outdoor air damper, or
- c. A design outdoor ventilation airflow of all systems serving the space combined greater than 3000 cfm.

EXCEPTIONS: 1. Systems with energy recovery complying with Section 1436.
2. Spaces with a combined design outdoor airflow less than 1000 cfm.
3. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1000 cfm.

1412.9 Enclosed Loading Dock and Parking Garage Exhaust Ventilation System Control. Mechanical ventilation systems for enclosed loading docks and parking garages shall be designed to exhaust the airflow rates (maximum and minimum) determined in accordance with the State Mechanical Code (chapter 51-52 WAC).

Ventilation systems shall be equipped with a control device that operates the system automatically upon detection of vehicle operation or the presence of occupants by approved automatic detection devices. Each of the following types of controllers shall be capable of shutting off fans or modulating fan speed.

1. Gas sensor controllers used to activate the exhaust ventilation system shall stage or modulate fan speed upon detection of specified gas levels. All equipment used in sensor controlled systems shall be designed for the specific use and installed in accordance with the manufacturer's recommendations. The following are minimum gas sensor system requirements:

a. Garages and loading docks used predominantly by gasoline-powered vehicles shall be equipped with a controller and a full array of carbon monoxide (CO) sensors set to maintain levels of carbon monoxide below 35 parts per million (ppm). Spacing and location of the sensors shall be installed in accordance with manufacturer recommendations.

b. Where more than 20 percent of the vehicles using the garage or loading dock are powered by nongasoline fuels, the

area exposed to nongasoline fueled vehicle exhaust shall be equipped with a controller and fuel-appropriate sensors. The set-point for the nongasoline sensors shall be no less than the standard used by OSHA for eight hour exposure. The controller shall activate the ventilation system when sensor set-point is reached. Spacing and location of the sensors shall be installed in accordance with manufacturer recommendations.

2. Automatic time clocks used to activate the system shall activate the system during occupied periods. The time clock shall be capable of scheduling multiple start and stop times for each day of the week, varying the daily schedule, and retaining programming for a 10-hour period during loss of power.

3. Occupant detection sensors used to activate the system shall detect entry into the parking garage along both the vehicle and pedestrian pathways.

1412.9.1 System Activation Devices for Enclosed Loading Docks. Ventilation systems for enclosed loading docks shall be activated by one of the following:

1. Gas sensors; or

2. Time clock and a manual over-ride switch located in the dock area that is accessible to persons in the loading dock area.

1412.9.2 System Activation Devices for Enclosed Parking Garages. Ventilation systems for enclosed parking garages shall be activated by gas sensors.

EXCEPTION: A parking garage ventilation system having a total design capacity under 8,000 cfm may use a time clock or occupant sensors.

AMENDATORY SECTION (Amending WSR 10-03-115, 10-13-113 and 10-22-056, filed 1/20/10, 6/21/10 and 10/28/10, effective 1/1/11)

WAC 51-11-1436 Heat recovery.

1436.1 Fan Systems: Fan systems which have a minimum outdoor air capacity of 5,000 cfm or greater shall have a heat recovery system with at least 50 percent recovery effectiveness. Fifty percent heat recovery effectiveness shall mean an increase in the outside air supply temperature at design heating conditions of one half the difference between the outdoor design air temperature and 65 degrees F. Provision shall be made to bypass or control the heat recovery system to permit air economizer operation as required by Section 1433. Heat recovery energy may be provided from any site-recovered or site-solar source. Where a single room or space is supplied by multiple units, the aggregate ventilation (cfm) of those units shall be used in applying this requirement.

EXCEPTIONS: These exceptions only apply to the particular exhaust subsystems. The remaining cfm of the main supply system is subject to the energy recovery requirements.

1. Laboratory systems equipped with both variable air volume supply and variable air volume or two-speed exhaust fume hoods provided that an instruction label is placed on the face of the hood that provides the information in Exhibit 14-1.

Exhibit 14-1

INSTRUCTIONS TO OPERATOR

To be in compliance with the Energy Code, this fume hood is designed to operate as variable air volume (VAV) by adjusting the sash or controller. Maintain sash in the minimum position during use and close totally when the fume hood is not in use.

2. Systems serving spaces heated to less than 60 degrees F.
3. Systems which can be shown to use as much energy with the addition of heat recovery equipment as without it.
4. Systems exhausting toxic, flammable, paint exhaust or corrosive fumes making the installation of heat recovery equipment impractical.
5. Type I commercial kitchen hoods.
6. Systems that only provide cooling.
7. Cooling only air handling units or air conditioning units where the minimum outdoor air is less than 70 percent of total supply air.

1436.2 Condensate Systems: On-site steam heating systems shall have condensate water recovery. On-site includes a system that is located within or adjacent to one or more buildings within the boundary of a contiguous area or campus under one ownership and which serves one or more of those buildings.

Buildings using steam generated off-site with steam heating systems which do not have condensate water recovery shall have condensate water heat recovery.

1436.3 Heat Recovery for Service Water Heating: Condenser water heat recovery systems shall be installed for heating or preheating of service hot water provided all of the following are true:

- a. The facility operates 24 hours a day.
- b. The total installed heat rejection capacity of the water-cooled systems exceeds 1,500,000 Btu/h of heat rejection.
- c. The capacity of service water heating equipment exceeds 250,000 Btu/h.

The required heat recovery system shall have the capacity to provide the smaller of:

- a. 60 percent of the peak heat rejection load at design conditions; or
- b. Preheat of the peak service hot water draw to 85°F; or
- c. 50 percent of the service water heating load.

- EXCEPTIONS:
1. Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.
 2. Facilities that provide 60 percent of their service water heating from site solar or site recovered energy or from other sources.

1436.4 Condenser Heat Recovery: Facilities having food service, meat or deli departments and having 500,000 Btu/h or greater of remote refrigeration condensers shall have condenser waste heat recovery from freezers and coolers and shall use the waste heat for service water heating, space heating or for dehumidification reheat. Facilities having a gross conditioned floor area of 40,000 ft² or greater and 1,000,000 Btu/h or greater of remote refrigeration shall have condenser waste heat recovery from freezers and coolers and shall use the waste heat for service water heating, and either for space

heating or for dehumidification reheat for maintaining low space humidity.

WSR 11-18-087

EXPEDITED RULES

BUILDING CODE COUNCIL

[Filed September 7, 2011, 8:53 a.m.]

Title of Rule and Other Identifying Information: Chapter 51-56 WAC, Washington state amendment of the 2009 Uniform Plumbing Code.

NOTICE

THIS RULE IS BEING PROPOSED UNDER AN EXPEDITED RULE-MAKING PROCESS THAT WILL ELIMINATE THE NEED FOR THE AGENCY TO HOLD PUBLIC HEARINGS, PREPARE A SMALL BUSINESS ECONOMIC IMPACT STATEMENT, OR PROVIDE RESPONSES TO THE CRITERIA FOR A SIGNIFICANT LEGISLATIVE RULE. IF YOU OBJECT TO THIS USE OF THE EXPEDITED RULE-MAKING PROCESS, YOU MUST EXPRESS YOUR OBJECTIONS IN WRITING AND THEY MUST BE SENT TO Tim Nogler, Managing Director, Washington State Building Code Council, P.O. Box 41449, Olympia, WA 98504-1449, AND RECEIVED BY November 10, 2011.

Purpose of the Proposal and Its Anticipated Effects, Including Any Changes in Existing Rules: WAC 51-56-0600, in Section 601.2.2 language was added to clarify that markings required for rainwater piping in Chapter 16 do not conflict with the marking requirements in Chapter 6. (OTS 4106.1)

WAC 51-11-1600, Section 1617.2.1 was modified to require pipe markings per industry standards. Section 1617.2.2 was amended to specify purple markings for rainwater system piping, per industry standards, as were Sections 1628.6.3 and 1629.2. (OTS 4107.1)

Reasons Supporting Proposal: Some editorial errors were identified in the rules filed under WSR 10-03-101. This rule corrects those errors.

Statutory Authority for Adoption: RCW 19.27A.025, 19.27A.045.

Statute Being Implemented: Chapters 19.27, 19.27A, and 34.05 RCW.

Rule is not necessitated by federal law, federal or state court decision.

Name of Proponent: State building code council, governmental.

Name of Agency Personnel Responsible for Drafting and Implementation: Krista Braaksma, P.O. Box 41449, Olympia, WA 98504-1449, (360) 407-9278; and Enforcement: Local jurisdictions.

September 6, 2011

Kristyn Clayton
Council Chair

AMENDATORY SECTION (Amending WSR 10-03-101, filed 1/20/10, effective 7/1/10)

WAC 51-56-0600 Chapter 6—Water supply and distribution. 601.1 Except where not deemed necessary for safety or sanitation by the AHJ, each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner, so arranged as to flush and keep it in a clean and sanitary condition without danger of backflow or cross-connection. Water closets and urinals shall be flushed by means of an approved flush tank or flushometer valve.

EXCEPTION: Listed fixtures that do not require water for their operation and are not connected to the water supply.

Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water. This requirement shall not supersede the requirements for individual temperature control limitations for public lavatories, bidets, bathtubs, whirlpool bathtubs and shower control valves.

601.2.2 Color and Information. Each system shall be identified with a colored pipe or band and coded with paints, wraps and materials compatible with the piping.

Except as required in Chapter 16, nonpotable water systems shall have a yellow background with black uppercase lettering, with the words "CAUTION: NONPOTABLE WATER, DO NOT DRINK." Each nonpotable system shall be identified to designate the liquid being conveyed, and the direction of normal flow shall be clearly shown. The minimum size of the letters and the length of color field shall conform to Table 6-1.

The background color and required information shall be indicated every twenty (20) feet (6,096 mm) but not less than once per room, and shall be visible from the floor level.

603.0 Cross-Connection Control. Cross-connection control shall be provided in accordance with the provisions of this

chapter. Devices or assemblies for protection of the public water system must be models approved by the department of health under WAC 246-290-490. The authority having jurisdiction shall coordinate with the local water purveyor where applicable in all matters concerning cross-connection control within the property lines of the premises.

No person shall install any water operated equipment or mechanism, or use any water treating chemical or substance, if it is found that such equipment, mechanism, chemical or substance may cause pollution or contamination of the domestic water supply. Such equipment or mechanism may be permitted only when equipped with an approved backflow prevention device or assembly.

603.1 Approval of Devices or Assemblies. Before any device or assembly is installed for the prevention of backflow, it shall have first been approved by the authority having jurisdiction. Devices or assemblies shall be tested for conformity with recognized standards or other standards acceptable to the authority having jurisdiction. Backflow prevention devices and assemblies shall comply with Table 6-2, except for specific applications and provisions as stated in Section 603.4 through 603.4.22.

All devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. Such devices or assemblies shall be tested in accordance with Section 603.3.3 and WAC 246-290-490. If found to be defective or inoperative, the device or assembly shall be replaced or repaired. No device or assembly shall be removed from use or relocated or other device or assembly substituted, without the approval of the authority having jurisdiction.

Testing shall be performed by a Washington state department of health certified backflow assembly tester.

**TABLE 6-2
Backflow Prevention Devices, Assemblies and Methods**

The following line is deleted from the table:

Device, Assembly or Method	Applicable Standards	Pollution (Low Hazard)		Contamination (High Hazard)		Installation
		Back Siphonage	Back Pressure	Back Siphonage	Back Pressure	
Backflow preventer for carbonated beverage dispensers (two independent check valves with a vent to the atmosphere.)	ASSE 1022	X				Installation includes carbonated beverage machines or dispensers. These devices operate under intermittent or continuous pressure conditions.

603.3.3 For devices and assemblies other than those regulated by the Washington department of health in conjunction with the local water purveyor for the protection of public water systems, the authority having jurisdiction shall ensure that the premise owner or responsible person shall have the backflow prevention assembly tested by a Washington state department of health certified backflow assembly tester:

- (1) At the time of installation, repair or relocation; and
- (2) At least on an annual schedule thereafter, unless more frequent testing is required by the authority having jurisdiction.

603.4.6.1 Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected from backflow by one of the following devices:

- (1) Atmospheric vacuum breaker.
- (2) Pressure vacuum breaker.
- (3) Spill-resistant pressure vacuum breaker.
- (4) Reduced pressure backflow preventer.
- (5) A double check valve may be allowed when approved by the water purveyor and the authority having jurisdiction.

603.4.10 Potable Water Make Up Connections to Steam or Hot Water Boilers shall be protected by an air gap or a reduced pressure principle backflow preventer.

603.4.12 Potable Water Supply to Carbonators shall be protected by a listed reduced pressure principle backflow preventer as approved by the authority having jurisdiction for the specific use. The backflow preventer shall be located in accordance with Section 603.3.4. The piping downstream of the backflow preventer shall not be of copper, copper alloy, or other material that is affected by carbon dioxide.

603.4.14 Backflow preventers shall not be located in any area containing fumes or aerosols that are toxic, poisonous, infectious, or corrosive.

603.4.16.1 Except as provided under Sections 603.4.16.2 and 603.4.16.3, potable water supplies to fire protection systems that are normally under pressure, including but not limited to standpipes and automatic sprinkler systems, except in one or two family residential flow-through or combination sprinkler systems piped in materials approved for potable water distribution systems, shall be protected from back-pressure and back-siphonage by one of the following testable devices:

1. Double check valve assembly.
2. Double check detector assembly.
3. Reduced pressure backflow preventer.
4. Reduced pressure detector assembly.

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall meet the requirements of the appropriate standard(s) referenced in Table 14-1.

604.15 Plastic water service piping may terminate within a building, provided the connection to the potable water distribution system shall be made as near as is practical to the point of entry and shall be accessible. Barbed insert fittings with

hose clamps are prohibited as a transition fitting within the building.

608.5 Relief valves located inside a building shall be provided with a drain, not smaller than the relief valve outlet, of galvanized steel, hard drawn copper piping and fittings, CPVC, or listed relief valve drain tube with fittings which will not reduce the internal bore of the pipe or tubing (straight lengths as opposed to coils) and shall extend from the valve to the outside of the building, with the end of the pipe not more than two (2) feet (610 mm) nor less than six (6) inches (152 mm) above the ground or the flood level of the area receiving the discharge and pointing downward. Such drains may terminate at other approved locations. No part of such drain pipe shall be trapped or subject to freezing. The terminal end of the drain pipe shall not be threaded.

EXCEPTION: Replacement water heating equipment shall only be required to provide a drain pointing downward from the relief valve to extend between two feet (610 mm) and six inches (152 mm) from the floor. No additional floor drain need be provided.

610.4 Systems within the range of Table 6-6 may be sized from that table or by the method set forth in Section 610.5.

Listed parallel water distribution systems shall be installed in accordance with their listing.

AMENDATORY SECTION (Amending WSR 10-03-101, filed 1/20/10, effective 7/1/10)

WAC 51-56-1600 Chapter 16—Gray water systems.

Part I, Gray Water Systems, is not adopted. Gray water shall not be used for irrigation except as permitted by the department of health rules.

Part II

1613. Nonpotable Reuse Water Systems—General.

(A) The provisions of Part II of this chapter shall apply to the installation, construction, alteration, and repair of non-potable reuse water intended to supply uses such as water closets, urinals, and trap primers for floor drains, and floor sinks, irrigation, industrial processes, water features and other uses approved by the Authority Having Jurisdiction. Potable water supplied as makeup water in these systems shall be protected against back-pressure and backsiphonage in accordance with Sections 602.0 and 603.0.

(B) No permit for any nonpotable reuse water system shall be issued until complete plumbing plans, with appropriate data satisfactory to the Authority Having Jurisdiction, have been submitted and approved. No changes or connections shall be made to either the nonpotable water system or the potable water system within any site containing a non-potable reuse water system without approval by the Authority Having Jurisdiction.

(C) Before the building is occupied, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

(D) A nonpotable reuse water system shall be designed by a person registered or licensed to perform plumbing design work.

1614.0 Definitions. Nonpotable reuse water shall include the following:

Reclaimed Water - Water derived in any part from wastewater with a domestic wastewater component that has been adequately and reliably treated, so that it can be used for beneficial purposes. Reclaimed water is not considered a wastewater (RCW 90.46.010);

Greywater or Gray Water - Domestic type flows from bathtubs, showers, bathroom sinks, washing machines, dishwashers, and kitchen or utility sinks. Gray water does not include flow from a toilet or urinal (RCW 90.46.010); and

Other nonpotable wastewater sources from appliances and fixtures excluding wastewater streams containing black water.

For rainwater harvesting, see Part III.

1615.0 Permit. It shall be unlawful for any person to construct, install, alter, or cause to be constructed, installed, or altered any nonpotable reused water system within a building or on a premises without first obtaining a permit to do such work from the Authority Having Jurisdiction.

1616.0 Drawings and Specifications. The Authority Having Jurisdiction shall be permitted to require any or all of the following information to be included with or in the plot plan before a permit is issued for a nonpotable reused water system.

(A) A plot plan drawn to scale and completely dimensioned, showing lot lines and structures, location of present and proposed potable water supplies and meters, water wells, streams, auxiliary water supply and systems, nonpotable reused water supply and meters, drain lines, and locations of private sewage disposal systems and 100 percent expansion areas or building sewer connected to the public sewer.

(B) Details of construction including riser diagrams or isometrics and a full description of the complete installation, including installation methods, construction, and materials as required by the Authority Having Jurisdiction. To the extent permitted by structural conditions, nonpotable reused water risers within the toilet room, including appurtenances such as air/vacuum relief valves, pressure reducing valves, etc., shall be installed in the opposite end of the room containing the served fixtures from the potable water risers or opposite walls, as applicable. To the extent permitted by structural conditions, nonpotable reused water headers and branches off risers shall not be run in the same wall or ceiling cavity of the toilet room where potable water piping is run.

(C) Detailed initial and annual testing requirements as outlined elsewhere in this chapter.

1617.0 Pipe Material/Pipe Identification. Nonpotable reused water systems shall comply with Sections 1617.1 and 1617.2.

1617.1 Pipe Materials. Reclaimed water and nonpotable water reuse pipe, valves and fittings shall conform to the requirements of Sections 604.0, 605.0 and 606.0.

1617.2 Color and Information.

1617.2.1 Reclaimed Water. Reclaimed water systems shall have a purple background with black uppercase lettering with the words "CAUTION: RECLAIMED WATER, DO NOT DRINK." The minimum size of the letters and length of the color field shall conform to Table 6-1. Where used, a colored identification band shall be indicated every twenty feet (6,096 mm) not less than once per room, and shall be visible from the floor level. Where concealed within construction, the piping shall be labeled on two opposing sides of the pipe within each stud or joist bay. Marking is not required for pipe manufactured with purple color integral to the pipe and marked with black uppercase lettering to read "CAUTION: NONPOTABLE RECLAIMED WATER, DO NOT DRINK" in intervals not to exceed five feet (1,524 mm). All valves, except fixture supply control valves shall be equipped with a locking feature. All mechanical equipment that is appurtenant to the reclaimed water system shall be painted purple.

1617.2.2 Other Nonpotable Reused Water. Except as noted in Section 1617.2.1, nonpotable water systems shall have a (~~yellow~~) purple background with black uppercase lettering, with the words "CAUTION: NONPOTABLE WATER, DO NOT DRINK." Each nonpotable system shall be identified to designate the liquid being conveyed, and the direction of normal flow shall be clearly shown. The minimum size of the letters and length of the color field shall conform to Table 6-1.

The background color and required information shall be indicated every twenty feet but not less than once per room, and shall be visible from the floor level. Where concealed within construction, the piping shall be labeled on two opposing sides of the pipe within each stud or joist bay. All mechanical equipment that is appurtenant to the nonpotable reused water system shall be painted purple.

1618.0 Installation.

1618.1 Collection Reservoir. Nonpotable reuse water shall be collected in an approved reservoir constructed of durable, nonabsorbent and corrosion-resistant materials. The reservoir shall be a closed and gas-tight vessel. Access openings shall be provided to allow inspection and cleaning of the reservoir interior. The reservoir shall be sized to limit the retention time of nonpotable reuse water to a maximum of seventy-two hours.

1618.1.1 Filtration. Nonpotable reuse water entering the reservoir shall pass through an approved filter such as a media, sand or diatomaceous earth filter.

1618.1.2 Required Valve. A full-open valve shall be installed downstream of the last fixture connection to the nonpotable reuse water discharge pipe before entering the required filter.

1618.1.3 Overflow. The collection reservoir shall be equipped with an overflow pipe of the same diameter as, or larger than, the influent pipe for the nonpotable reuse water. The overflow shall be indirectly connected to the sanitary drainage system.

1618.1.4 Drain. A drain shall be located at the lowest point of the collection reservoir and shall be indirectly connected to the sanitary drainage system. The drain shall be the same diameter as the overflow pipe required in Section 1618.1.3.

1618.1.5 Disinfection. Nonpotable reuse water shall be disinfected by an approved method that uses one or more disinfectants such as chlorine, iodine or ozone.

1618.1.6 Makeup Water. Potable water shall be supplied as a source of makeup water for nonpotable water systems that serve plumbing fixtures. The potable supply shall be protected against backflow in accordance with Chapter 6. A full-open valve shall be located on the makeup water supply line to the collection reservoir.

(A) Hose bibbs shall not be allowed on nonpotable reuse water piping systems.

(B) The nonpotable reuse water system and the potable water system within the building shall be provided with the required appurtenances (valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required by this chapter for a cross-connection test in Section 1620.0.

(C) Nonpotable reuse water pipes shall not be run or laid in the same trench as potable water pipes. A ten foot (3,048 mm) horizontal separation shall be maintained between pressurized, buried reclaimed and potable water piping. Buried potable water pipes crossing pressurized nonpotable reuse water pipes shall be laid not less than twelve inches (305 mm) above the nonpotable reuse water pipes. Nonpotable reuse water pipes laid in the same trench or crossing building sewer or drainage piping shall be installed in compliance with Sections 609.0 and 720.0 of this code. Nonpotable reuse water pipes shall be protected similar to potable water pipes.

1619.0 Signs.

1619.1 Commercial, Industrial and Institutional Room Entrance Signs. In commercial, industrial, and institutional occupancies, all rooms using nonpotable reuse water for water closets and/or urinals shall be identified with signs. Each sign shall contain one-half inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) shall be visible to all users. The number and location of the signs shall be approved by the Authority Having Jurisdiction and shall contain the following text:

TO CONSERVE WATER,
THIS BUILDING USES RECLAIMED WATER TO FLUSH TOILETS AND URINALS.

1619.2 Equipment Room Signs. Each room containing nonpotable reuse water equipment shall have a sign posted with the following wording in one-inch (25.4 mm) letters on a purple background:

CAUTION
NONPOTABLE RECLAIMED WATER, DO NOT DRINK.
DO NOT CONNECT TO DRINKING WATER SYSTEM.

NOTICE
CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

This sign shall be posted in a location that is visible to anyone working on or near nonpotable reuse water equipment.

1619.3 Where water closets and/or urinals are flushed with nonpotable reuse water, the fixture shall be labeled:

CAUTION
TO CONSERVE WATER, THIS BUILDING USES NONPOTABLE RECLAIMED WATER TO FLUSH TOILETS AND URINALS

1619.4 Valve Access Door Signs. Each nonpotable reuse water valve within a wall shall have its access door into the wall equipped with a warning sign approximately six inches by six inches (152 mm x 152 mm) with wording in one-half inch (12.7 mm) letters on a purple background. The size, shape, and format of the sign shall be substantially the same as that specified in subsection (B) above. The signs shall be attached inside the access door frame and shall hang in the center of the access door frame. This sign requirement shall be applicable to any and all access doors, hatches, etc., leading to nonpotable reuse water piping and appurtenances.

1620.0 Inspection and Testing.

1620.1 Nonpotable reuse water piping shall be inspected and tested as outlined in this code for testing of potable water piping.

1620.2 An initial and subsequent annual inspection and test shall be performed on both the potable and nonpotable reuse water systems. The potable and nonpotable reuse water systems shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection as follows:

1620.2.1 Visual Dual System Inspection. Prior to commencing the cross-connection testing, a dual system inspection shall be conducted by the Authority Having Jurisdiction and other authorities having jurisdiction.

(i) Meter locations of the nonpotable reuse water and potable water lines shall be checked to verify that no modifications were made, and that no cross-connections are visible.

(ii) Pumps and equipment, equipment room signs, and exposed piping in the equipment room shall be checked.

(iii) Valves shall be checked to ensure that valve lock seals are still in place and intact. Valve control door signs shall be checked to verify that no signs have been removed.

1620.2.2 Cross-Connection Test. The following procedure shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross connection occurred.

(i) The potable water system shall be activated and pressurized. The nonpotable reuse water system shall be shut down and completely drained.

(ii) The potable water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the nonpotable reuse water system is empty. The minimum period the nonpotable reuse water system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complex-

ity of the potable and nonpotable reuse water distribution systems, but in no case shall that period be less than one hour.

(iii) Fixtures, potable and reclaimed, shall be tested and inspected for flow. Flow from any nonpotable reuse water system outlet shall indicate a cross-connection. No flow from a potable water outlet would indicate that it is connected to the nonpotable reuse water system.

(iv) The drain on the nonpotable reuse water system shall be checked for flow during the test and at the end of the period.

(v) The potable water system shall then be completely drained.

(vi) The nonpotable reuse water system shall then be activated and pressurized.

(vii) The nonpotable reuse water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than one hour.

(viii) Fixtures, potable and reclaimed, shall be tested and inspected for flow. Flow from any potable water system outlet shall indicate a cross-connection. No flow from a nonpotable reuse water outlet would indicate that it is connected to the potable water system.

(ix) The drain on the potable water system shall be checked for flow during the test and at the end of the period.

(x) If there is no flow detected in any of the fixtures that would have indicated a cross-connection, the potable water system shall be repressurized.

1620.2.3 Cross-Connection Discovered. The following procedure, in the presence of the Authority Having Jurisdiction, shall be activated immediately:

(i) Nonpotable reuse water piping to the building shall be shut down at the meter, and the nonpotable reuse water riser shall be drained.

(ii) Potable water piping to the building shall be shut down at the meter.

(iii) The cross-connection shall be uncovered and disconnected.

(iv) The building shall be retested following procedures listed in subsections (B)(1) and (2) above.

(v) The potable water system shall be chlorinated with fifty ppm chlorine for twenty-four hours.

(vi) The potable water system shall be flushed after twenty-four hours, and a standard bacteriological test shall be performed. If test results are acceptable, the potable water system shall be permitted to be recharged.

1620.3 An annual inspection of the nonpotable reuse water system, following the procedures listed in subsection 1620.0 (B)(1), shall be required. Annual cross-connection testing, following the procedures listed in subsection 1620.0 (B)(2), shall be required by the Authority Having Jurisdiction, unless site conditions do not require it. In no event shall the test occur less often than once in four years. Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.

1621.0 Sizing. Nonpotable reuse water piping shall be sized as outlined in this code for sizing potable water piping.

1622.0 Abandonment of Nonpotable Reuse Water Systems. Where nonpotable reuse water systems are abandoned, the procedure for abandonment shall be as required by the Authority Having Jurisdiction. Components of the abandoned system, including, but not limited to, pipe, tubing, fittings and valves shall not be used for potable water systems.

Part III

1623.0 Rainwater Harvesting Systems - General. All components of the system not specifically addressed by the provisions of Part III of this chapter shall meet all applicable sections of this code, and any applicable manufacturer's installation instructions.

Engineered systems shall be installed per plans and specifications of the engineer of record.

1624.0 Scope. Applications for rainwater harvesting are unique for each application. For this reason, each rainwater harvesting system proposed for use must be engineered and site-specific and are subject to the approval of the Authority Having Jurisdiction. The requirement for the system to be engineered may be waived by the Authority Having Jurisdiction.

1624.1 Water Uses. Harvested rainwater uses may include water closets, urinals, hose bibbs, industrial applications, and irrigation purposes. Other uses may be allowed when first approved by the Authority Having Jurisdiction.

1625.0 Definitions. In addition to other definitions used in the Uniform Plumbing Code, the following definitions apply to rainwater harvesting systems.

1625.1 Auxiliary Supply. The piping arranged and protected from contamination to provide an alternate means of filling a cistern.

1625.2 Cistern. The central storage component of the rainwater harvesting system. Protection and maintenance of the cistern is essential for the health of the system.

1625.3 Debris Excluder. A screen or other device installed on the gutter or downspout system to prevent the accumulation of leaves, needles, or other debris in the system.

1625.4 Flat. Having a slope no greater than 1 in 50.

1625.5 Piping System. The system of pipes that conveys the harvested rainwater and distributes it to various fixtures.

1625.6 Prefiltration. A device to mechanically remove sediment and debris.

1625.7 Pump or Pressure System. The mechanical device necessary to distribute the harvested rainwater from the cistern to the designated fixtures.

1625.8 Rainwater Harvesting System (RWS). A cistern(s), pipe, fittings, pumps and other plumbing appurtenances required for and/or used to harvest and distribute rainwater.

1625.9 Return Elbow. A section of pipe with a 180-degree bend.

1625.10 Roof Drainage System. The roof drains, overflow drains, scuppers, gutters and downspouts used to convey the rainwater from the roof surface to the system.

1625.11 Roof Surface. The surface rainwater harvesting systems rely on for the collection of rainwater that has fallen on a building roof.

1625.12 Roof Wash or Roof Washer. A device or method for removal of sediment and debris from collected roof water by diverting initial rainfall from entry into the cistern(s).

1625.13 Screen. Corrosion resistant wire or other approved mesh having openings in determined sizes.

1625.14 Slope or Sloping. Having a slope greater than 1 in 50.

1625.15 Transfer Pump. The mechanical device to transfer collected water from downspouts to remote cistern(s).

1626.0 Permit. It shall be unlawful for any person to construct, install, alter, or cause to be constructed, installed, or altered any rainwater harvesting system within a building or on a premises without first obtaining a permit to do such work from the Authority Having Jurisdiction.

In addition to the permits required by this Code, the following additional permits may be required for the installation of a rainwater harvesting system: An electrical permit for the pump or other electrical controls; a building permit for cistern footings, foundations, enclosures and roof structures; a grading permit may be necessary for underground tanks. In addition, contact your regional office of the department of ecology regarding a registration form.

1626.1 Application. The following information must be provided with each permit application for a rainwater harvesting system:

1. Site or plot plan, including site elevations.
2. A diagram of the rainwater harvesting system (including piping and equipment) and domestic potable water systems, including sizing and dimensions.
3. Specifications and manufacturer's installation instructions for cistern(s), pump(s), filtration and/or disinfection, and roof washing or pre-filtration system(s).
4. Engineering. Installation, including, but not limited to, the following systems, will require structural engineering: Cisterns that are located on top of a building structure or cisterns that are located on sloping sites.

Information in addition to that listed above may be necessary in some instances. The size and complexity of the building, site and system will determine the necessity for additional information.

1627.0 General Provisions. A rainwater harvesting system begins at the point of collection and terminates as waste after the water collected has been used in plumbing fixtures, industrial applications, or used for irrigation purposes. The parts of the collection and distribution system include the roof surface, gutters and downspouts, roof washer, cistern, pump and the piping system.

1627.1 Collection System. Rainwater shall only be harvested from roof surfaces. Harvest shall not occur from the following locations:

1. Any vehicular or pedestrian area;
2. Surface water runoff; or
3. Bodies of standing water.

1627.2 Collection Pretreatment. Rainwater harvested from roof surfaces shall be pretreated by either a roof washing system or other filtration system of no more than 50 microns. The quantity of the first flush generated by the rainwater harvesting system during any rain event shall be calculated as the first 0.02 inch of rainfall per 24-hour period per square foot of roof area and shall be diverted away from the cistern. Discharge of any diverted water shall go to a location approved by the Administrative Authority.

EXCEPTIONS:

1. A first flush is not required where a post storage filtration or treatment system is installed and approved by the Administrative Authority.
2. A first flush is not required for systems used exclusively for irrigation purposes.

1628.0 System Components.

1628.1 Roof Surface. The roof surface may be constructed of any material accepted by the Administrative Authority.

EXCEPTION: Copper, zinc or lead roofing materials shall not be used.

1628.2 Roof Drainage System. Gutters and downspouts used to collect rainwater shall comply with the following:

1. Gutters and downspouts may be manufactured of any material. Gutter and downspout materials are not required to meet material specifications found in the Uniform Plumbing Code.

EXCEPTION: Copper or zinc gutters and downspouts shall not be used. If existing gutters and downspouts are already in place, the interior shall be coated with a NSF-quality epoxy paint.

2. Gutter and downspout systems leading to the cistern shall be fitted with debris excluders.

1628.3 Roof Washers and Prefiltration. All rainwater harvesting systems using impervious roof surfaces shall have at least one roof washer per downspout or prefiltration system. A roof washer or prefiltration system is not required for pervious roof surfaces such as green roofs. Roof washers and prefiltration systems shall meet the following design requirements.

1628.3.1 All collected rainwater shall pass through a roof washer or prefiltration system before the water enters the cistern(s).

1628.3.2 If more than one cistern is used, a roof washer or prefiltration system shall be provided for each cistern.

EXCEPTION: Where a series of cisterns are interconnected to supply water to a single system.

1628.3.3 The following requirements apply to all roof washers.

1628.3.3.1 The inlet to the roof washer shall be provided with a debris screen that protects the roof washer from the intrusion of waste and vermin.

1628.3.3.2 The roof washer shall rely on manually operated valves or other devices to do the diversion.

1628.3.3.8 Roof washers shall be readily accessible for regular maintenance.

1628.3.4 Prefiltration screens or filters shall be maintained consistent with manufacturer's specifications.

1628.4 Cisterns. The following are the minimum requirements for cisterns.

1628.4.1 General.

1628.4.1.1 All cisterns shall be listed for use with potable water.

1628.4.1.2 Cisterns shall be capable of being filled from both the rainwater harvesting system and the public or private water system.

1628.4.1.3 The municipal or on-site well water system shall be protected from cross-contamination in accordance with Section 603.4.5.

1628.4.1.4 Backflow assemblies shall be maintained and tested in accordance with Section 603.3.3.

1628.4.1.5 Cisterns may be used as storm water collection points that help to minimize flood damage, while providing a reservoir for later use.

1628.4.1.6 Cisterns shall have access to allow inspection and cleaning.

1628.4.2 Size. Any cistern, or combination of cisterns used, shall be sized adequately for the intended use of the water.

1628.4.2.1 For above grade cisterns, the ratio of the cistern size shall not be greater than 1:1 height to width, provided that for an engineered tank with an engineered foundation, the height may exceed the width, subject to approval of the Authority Having Jurisdiction. The ratio for below grade cisterns is not limited.

1628.4.3 Location. Cisterns may be installed either above or below grade. All cisterns shall be installed in accordance with the manufacturer's installation instructions. Where the installation requires a foundation, the foundation shall be flat and shall be capable of supporting the cistern weight when the cistern is full.

1628.4.3.1 Below Grade Cisterns. Below grade cisterns shall be provided with manhole risers a minimum of 8 inches above surrounding grade. Underground cisterns shall have tiedowns per manufacturer's specifications, or the excavated site must have a daylight drain or some other drainage mechanism to prevent floating of the cistern resulting from elevated groundwater levels.

1628.4.4 Protection. Cisterns shall be protected from sunlight to inhibit algae growth and ensure life expectancy of tank.

1628.4.5 Inlets, Outlets and Openings. All cistern openings shall be protected from unintentional entry by humans or vermin. Manhole covers shall be provided and shall be secured

to prevent tampering. Where an opening is provided that could allow the entry of personnel, the opening shall be marked, "DANGER - CONFINED SPACE."

Cistern outlets shall be located at least 4 inches above the bottom of the cistern.

1628.4.6 Overflow. The cistern shall be equipped with an overflow device.

1628.4.6.1 The overflow device shall consist of a pipe equal to or greater than the cistern inlet and a minimum of 4 inches below any makeup device from other sources.

1628.4.6.2 The overflow outlet shall be protected with a screen having openings no greater than 0.25 inches or a self-sealing cover.

1628.4.6.3 The Authority Having Jurisdiction shall approve the discharge location of the overflow water.

1628.5 Pump. Where a pump is provided in conjunction with the rainwater harvesting system, the pump shall meet the following provisions.

1628.5.1 The pump and all other pump components shall be listed and approved for use with potable water systems.

1628.5.2 The pump shall be capable of delivering a minimum of 15 psi residual pressure at the highest outlet served. Minimum pump pressure shall allow for friction and other pressure losses. Maximum pressures shall not exceed 80 psi.

1628.6 Piping.

1628.6.1 There shall be no direct connection of any rainwater harvesting pipe system and any domestic potable water pipe system.

1628.6.2 Materials. Pipe used to convey harvested rainwater shall be identified per Section 601.2 and Table 6-1. Fittings and other system components shall be listed for use in conjunction with specified piping. Both piping and fittings shall be installed as required by applicable code and standards.

1628.6.2.1 All other products entering into the construction of a rainwater harvesting system shall be listed as required by code for the purpose intended, and suitable for use in a potable water system.

1628.6.3 Color and Information. All rainwater pipe shall ~~((be marked))~~ have a purple background with black uppercase lettering, with the words "CAUTION: NONPOTABLE RAINWATER, DO NOT DRINK" every ((four)) twenty feet along its length, but in no case less than once per room((-The pipe and lettering shall comply with Section 601.2)), and shall be visible from the floor level. The minimum size of the letters and the length of the color field shall conform to Table 6-1. Where concealed within construction, the piping shall be labeled on two opposing sides of the pipe within each stud or joist bay. All mechanical equipment that is appurtenant to the nonpotable rainwater system shall be painted purple.

1629.0 Signs.

1629.1 Commercial, Industrial and Institutional Room Entrance Signs. In commercial, industrial, and institutional occupancies, all rooms using nonpotable reuse water for

water closets and/or urinals shall be identified with signs. Each sign shall contain one-half inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) shall be visible to all users. The number and location of the signs shall be approved by the Authority Having Jurisdiction and shall contain the following text:

**TO CONSERVE WATER,
THIS BUILDING USES RAINWATER TO FLUSH TOILETS AND
URINALS.**

1629.2 Equipment Room Signs. Each room containing nonpotable (~~(reuse water)~~) rainwater equipment shall have a sign posted with the following wording in one-inch (25.4 mm) letters (~~(of a highly visible color)~~) on a (~~(contrasting)~~) purple background:

**CAUTION
NONPOTABLE RAINWATER, DO NOT DRINK.
DO NOT CONNECT TO DRINKING WATER SYSTEM.
NOTICE
CONTACT BUILDING MANAGEMENT
BEFORE PERFORMING ANY WORK ON THIS WATER SYS-
TEM.**

This sign shall be posted in a location that is visible to anyone working on or near nonpotable reuse water equipment.

1629.3 Every water closet or urinal supply, hose bibb or irrigation outlet shall be permanently identified with an indelibly marked placard stating:

**CAUTION
NONPOTABLE RAINWATER, DO NOT DRINK**

1630.0 Inspection and Testing.

(A) Rainwater harvesting systems shall be inspected and tested as outlined in this code for testing of potable water piping.

(B) An initial inspection and test shall be performed on both the potable and rainwater harvesting systems. The potable and rainwater system shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection.

1631.0 System Maintenance. Rainwater harvesting systems shall be maintained in functioning order for the life of the system. It is the property owner's responsibility to maintain the system until the system is abandoned as prescribed in this code.

1632.0 System Abandonment. If the owner of a rainwater harvesting system elects to cease use of, or fails to properly maintain such system, they shall abandon the system. To abandon the system one shall:

1. Remove the system entirely; and
2. Replace the rainwater harvesting pipe system with an approved potable water supply pipe system. Where an existing potable pipe system is already in place, fixtures may be reconnected to the existing system.

Rainwater harvesting system abandonment and potable water installations require permit, inspection(s) and approval(s).

**WSR 11-18-088
EXPEDITED RULES
BUILDING CODE COUNCIL**

[Filed September 7, 2011, 9:03 a.m.]

Title of Rule and Other Identifying Information: Chapter 51-52 WAC, Washington state amendment of the 2009 International Mechanical Code.

NOTICE

THIS RULE IS BEING PROPOSED UNDER AN EXPEDITED RULE-MAKING PROCESS THAT WILL ELIMINATE THE NEED FOR THE AGENCY TO HOLD PUBLIC HEARINGS, PREPARE A SMALL BUSINESS ECONOMIC IMPACT STATEMENT, OR PROVIDE RESPONSES TO THE CRITERIA FOR A SIGNIFICANT LEGISLATIVE RULE. IF YOU OBJECT TO THIS USE OF THE EXPEDITED RULE-MAKING PROCESS, YOU MUST EXPRESS YOUR OBJECTIONS IN WRITING AND THEY MUST BE SENT TO Tim Nogler, Managing Director, Washington State Building Code Council, P.O. Box 41449, Olympia, WA 98504-1449, AND RECEIVED BY November 10, 2011.

Purpose of the Proposal and Its Anticipated Effects, Including Any Changes in Existing Rules: WAC 51-52-0403, a typographical error in the exception to Section 403.8.5.2 was corrected.

Reasons Supporting Proposal: An editorial error was identified in the rules filed under WSR 10-03-099. This rule corrects that error.

Statutory Authority for Adoption: RCW 19.27A.025, 19.27A.045.

Statute Being Implemented: Chapters 19.27, 19.27A, and 34.05 RCW.

Rule is not necessitated by federal law, federal or state court decision.

Name of Proponent: State building code council, governmental.

Name of Agency Personnel Responsible for Drafting and Implementation: Krista Braaksma, P.O. Box 41449, Olympia, WA 98504-1449, (360) 407-9278; and Enforcement: Local jurisdictions.

September 6, 2011

Kristyn Clayton
Council Chair

AMENDATORY SECTION (Amending WSR 10-03-099, filed 1/20/10, effective 7/1/10)

WAC 51-52-0403 Section 403—Mechanical ventilation.

403.2 Outdoor air required. The minimum ventilation rate of outdoor air shall be determined in accordance with Section 403.3.

EXCEPTIONS:

1. Where the registered design professional demonstrates that an engineered ventilation system design will prevent the maximum concentration of contaminants from exceeding that obtainable by the rate of outdoor air ventilation determined in accordance with Section 403.3, the minimum required rate of outdoor

air shall be reduced in accordance with such engineered system design.
 2. Alternate systems designed in accordance with ASHRAE Standard 62.1 Section 6.2, Ventilation Rate Procedure, shall be permitted.

403.2.1 Recirculation of air. The air required by Section 403.3 shall not be recirculated. Air in excess of that required by Section 403.3 shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one dwelling to another or to dissimilar occupancies.
2. Supply air to a swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces where 10 percent or more of the resulting supply air-stream consists of air recirculated from these spaces.
3. Where mechanical exhaust is required by Note b in Table 403.3, recirculation of air from such spaces shall be prohibited. All air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 403.3.
 (Item 4 is not adopted.)

403.3 Outdoor airflow rate. Ventilation systems shall be designed to have the capacity to supply the minimum outdoor

airflow rate determined in accordance with this section. The occupant load utilized for design of the ventilation system shall not be less than the number determined from the estimated maximum occupant load rate indicated in Table 403.3. Ventilation rates for occupancies not represented in Table 403.3 shall be those for a listed occupancy classification that is most similar in terms of occupant density, activities and building construction; or shall be determined by an approved engineering analysis. The ventilation system shall be designed to supply the required rate of ventilation air continuously during the period the building is occupied, except as otherwise stated in other provisions of the code.

With the exception of smoking lounges, the ventilation rates in Table 403.3 are based on the absence of smoking in occupiable spaces. Where smoking is anticipated in a space other than a smoking lounge, the ventilation system serving the space shall be designed to provide ventilation over and above that required by Table 403.3 in accordance with accepted engineering practice.

EXCEPTION: Where occupancy density is known and documented in the plans, the outside air rate may be based on the design occupant density. Under no circumstance shall the occupancies used result in outside air less than one-half that resulting from application of Table 403.3 estimated maximum occupancy rates.

**Table 403.3
 Required Outdoor Ventilation Air**

Occupancy Classification	People Outdoor Airflow Rate in Breathing Zone cfm/Person	Area Outdoor Airflow Rate in Breathing Zone R _a cfm/ft ^{2a}	Default Occupant Density #/1000 ft ^{2a}	Exhaust Airflow Rate cfm/ft ²
Correctional facilities				
Cells				
without plumbing fixtures	5	0.12	25	—
with plumbing fixtures	5	0.12	25	1.0
Dining halls (see food and beverage service)	—	—	—	—
Guard stations	5	0.06	15	—
Day room	5	0.06	30	—
Booking/waiting	7.5	0.06	50	—
Dry cleaners, laundries				
Coin-operated dry cleaner	15	—	20	—
Coin-operated laundries	7.5	0.06	20	—
Commercial dry cleaner	30	—	30	—
Commercial laundry	25	—	10	—
Storage, pick up	7.5	0.12	30	—
Education				
Art classroom	10	0.18	20	0.7
Auditoriums	5	0.06	150	—
Classrooms (ages 5-8)	10	0.12	25	—
Classrooms (ages 9 plus)	10	0.12	35	—
Computer lab	10	0.12	25	—
Corridors (see public spaces)	—	—	—	—
Day care (through age 4)	10	0.18	25	—
Lecture classroom	7.5	0.06	65	—
Lecture hall (fixed seats)	7.5	0.06	150	—
Locker/dressing room	—	—	—	0.25
Media center	10	0.12	25	—

Occupancy Classification	People Outdoor Airflow Rate in Breathing Zone cfm/Person	Area Outdoor Airflow Rate in Breathing Zone R _a cfm/ft ^{2a}	Default Occupant Density #/1000 ft ^{2a}	Exhaust Airflow Rate cfm/ft ²
Multiuse assembly	7.5	0.06	100	—
Music/theater/dance	10	0.06	35	—
Science laboratories	10	0.18	25	1.0
Smoking lounges ^b	60	—	70	—
Sports locker rooms	—	—	—	0.5
Wood/metal shops	10	0.18	20	0.5
Food and beverage service				
Bars, cocktail lounges	7.5	0.18	100	—
Cafeteria, fast food	7.5	0.18	100	—
Dining rooms	7.5	0.18	70	—
Kitchens (cooking) ^b	—	—	—	0.7
Hospitals, nursing and convalescent homes				
Autopsy rooms ^b	—	—	—	0.5
Medical procedure rooms	15	—	20	—
Operating rooms	30	—	20	—
Patient rooms	25	—	10	—
Physical therapy	15	—	20	—
Recovery and ICU	15	—	20	—
Hotels, motels, resorts and dormitories				
Multipurpose assembly	5	0.06	120	—
Bathrooms/toilet—private	—	—	—	25/50 ^f
Bedroom/living room	5	0.06	10	—
Conference/meeting	5	0.06	50	—
Dormitory sleeping areas	5	0.06	20	—
Gambling casinos	7.5	0.18	120	—
Kitchens	—	—	—	25/100 ^f
Lobbies/prefunction	7.5	0.06	30	—
Offices				
Conference rooms	5	0.06	50	—
Office spaces	5	0.06	5	—
Reception areas	60	0.06	30	—
Telephone/data entry	5	0.06	60	—
Main entry lobbies	5	0.06	10	—
Private dwellings, single and multiple				
Garages, common for multiple units ^b	—	—	—	0.75
Garages, separate for each dwelling ^b	—	—	—	100 cfm per car
Kitchens ^b	—	—	—	25/100 ^f
Living areas ^c	See Tables 403.8.5.1 and 403.8.5.2	—	Based on the number of bedrooms. First bedroom: 2; each additional bedroom, 1	—
Toilet rooms, bathrooms and laundry areas ⁱ	—	—	—	20/50 ^f
Public spaces				
Corridors	—	0.06	—	—
Elevator car	—	—	—	1.0
Shower room (per shower head)	—	—	—	50/20 ^f
Smoking lounges ^b	60	—	70	—
Toilet rooms - public	—	—	—	50/70 ^e

Occupancy Classification	People Outdoor Airflow Rate in Breathing Zone cfm/Person	Area Outdoor Airflow Rate in Breathing Zone R _a cfm/ft ^{2a}	Default Occupant Density #/1000 ft ^{2a}	Exhaust Airflow Rate cfm/ft ²
Places of religious worship	5	0.06	120	—
Courtrooms	5	0.06	70	—
Legislative chambers	5	0.06	50	—
Libraries	5	0.12	10	—
Museums (children's)	7.5	0.12	40	—
Museums/galleries	7.5	0.06	40	—
Retail stores, sales floors and show-room floors				
Sales (except as below)	7.5	0.12	15	—
Dressing rooms	—	—	—	0.25
Mall common areas	7.5	0.06	40	—
Shipping and receiving	—	0.12	—	—
Smoking lounges ^b	60	—	70	—
Storage rooms	—	0.12	—	—
Warehouses (see storage)	—	—	—	—
Specialty shops				
Automotive motor-fuel-dispensing stations ^b	—	—	—	1.5
Barber	7.5	0.06	25	0.5
Beauty and nail salons ^{b,h}	20	0.12	25	0.6
Embalming room ^b	—	—	—	2.0
Pet shops (animal areas) ^b	7.5	0.18	10	0.9
Supermarkets	7.5	0.06	8	—
Sports and amusement				
Disco/dance floors	20	0.06	100	—
Bowling alleys (seating areas)	10	0.12	40	—
Game arcades	7.5	0.18	20	—
Ice arenas, without combustion engines	—	0.30	—	0.5
Gym, stadium arena (play area)	—	0.30	—	—
Spectator areas	7.5	0.06	150	—
Swimming pools (pool and deck area)	—	0.48	—	—
Health club/aerobics room	20	0.06	40	—
Health club/weight room	20	0.06	10	—
Storage				
Repair garages, enclosed parking garage ^{b,d}	—	—	—	0.75
Warehouses	—	0.06	—	—
Theaters				
Auditoriums (see education)	—	—	—	—
Lobbies	5	0.06	150	—
Stages, studios	10	0.06	70	—
Ticket booths	5	0.06	60	—
Transportation				
Platforms	7.5	0.06	100	—
Transportation waiting	7.5	0.06	100	—
Workrooms				
Bank vaults/safe deposit	5	0.06	5	—
Darkrooms	—	—	—	1.0
Copy, printing rooms	5	0.06	4	0.5
Meat processing ^c	15	—	10	—
Pharmacy (prep area)	5	0.18	10	—
Photo studios	5	0.12	10	—
Computer (without printing)	5	0.06	4	—

For SI: 1 cubic foot per minute = 0.0004719 m³/s, 1 ton = 908 kg, 1 cubic foot per minutes per square foot = 0.00508 m³/(s·m²), °C = [(°F) -32]/1.8, 1 square foot = 0.0929 m².

- a. Based upon net occupiable floor area.
- b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited (see Section 403.2.1, Item 3).
- c. Spaces unheated or maintained below 50°F are not covered by these requirements unless the occupancy is continuous.
- d. Ventilation systems in enclosed parking garages shall comply with Section 404.
- e. Rates are per water closet or urinal. The higher rate shall be provided where periods of heavy use are expected to occur, such as toilets in theaters, schools and sports facilities. The lower rate shall be permitted where periods of heavy use are not expected.
- f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted where the exhaust system is designed to operate continuously during normal hours of use.
- g. Reserved.

- h. For nail salons, the required exhaust shall include ventilation tables or other systems that capture the contaminants and odors at their source and are capable of exhausting a minimum of 50 cfm per station.
- i. A laundry area within a kitchen or bathroom is not required to have source specific exhaust. Where there are doors that separate the laundry area from the kitchen or bathroom the door shall be louvered.

403.8 Ventilation systems for Group R occupancies. Each dwelling unit or guest room shall be equipped with source specific and whole house ventilation systems and shall comply with Sections 403.8.1 through 403.8.11. All public corridors and other than Group R occupied spaces that support the Group R occupancy shall meet the ventilation requirements of Section 402 or Sections 403.1 to 403.7.

403.8.1 Minimum ventilation performance. Ventilation systems shall be designed and installed to satisfy the ventilation requirements of Table 403.3 or Table 403.8.1.

Table 403.8.1
Ventilation Rates for All Group R Private Dwellings, Single and Multiple
(Continuously Operating Systems)

Floor Area (ft ²)	Bedrooms ¹				
	0-1	2-3	4-5	6-7	>7
<1500	30	45	60	75	90
1501 - 3000	45	60	75	90	105
3001 - 4500	60	75	90	105	120
4501 - 6000	75	90	105	120	135
6001 - 7500	90	105	120	135	150
>7500	105	120	135	150	165

¹Ventilation rates in table are minimum outdoor airflow rates measured in cfm.

403.8.2 Control and operation.

- 1. Location of controls. Controls for all ventilation systems shall be readily accessible by the occupant.
- 2. Instructions. Operating instructions for whole house ventilation systems shall be provided to the occupant by the installer of the system.
- 3. Source specific ventilation systems. Source specific ventilation systems shall be controlled by manual switches, dehumidistats, timers, or other approved means.
- 4. Continuous whole house ventilation systems. Continuous whole house ventilation systems shall operate continuously. Exhaust fans, forced-air system fans, or supply fans shall be equipped with "fan on" as override controls. Controls shall be capable of operating the ventilation system without energizing other energy-consuming appliances. A label shall be affixed to the controls that reads "Whole House Ventilation (see operating instructions)."

5. Intermittent whole house ventilation systems. Intermittent whole house ventilation systems shall comply with the following:

- 5.1 They shall be capable of operating intermittently and continuously.
- 5.2 They shall have controls capable of operating the exhaust fans, forced-air system fans, or supply fans without energizing other energy-consuming appliances.

5.3 The ventilation rate shall be adjusted according to the exception in Section 403.8.5.1.

5.4 The system shall be designed so that it can operate automatically based on the type of control timer installed.

5.5 The intermittent mechanical ventilation system shall operate at least one hour out of every twelve.

5.6 The system shall have a manual control and automatic control, such as a 24-hour clock timer.

5.7 At the time of final inspection, the automatic control shall be set to operate the whole house fan according to the schedule used to calculate the whole house fan sizing.

5.8 A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

403.8.3 Outdoor air intake locations. Outdoor air intakes shall be classified as either operable openings or mechanical air intakes and shall be located per the following criteria. The intake locations for operable openings and mechanical air intakes shall comply with the following:

- 1. Openings for mechanical air intakes shall comply with Section 401.4. Operable openings shall comply with Section 401.4 items 2 and 4 only.
- 2. Intake openings shall not be located closer than 10 feet from an appliance vent outlet unless such vent outlet is 3 feet above the outdoor air inlet. The vent shall be permitted to be

closer if specifically allowed by Chapter 8 or by the International Fuel Gas Code.

3. Intake openings shall be located where they will not pick up objectionable odors, fumes, or flammable vapors.

4. Intake openings shall be located where they will not take air from a hazardous or unsanitary location.

5. Intake openings shall be located where they will not take air from a room or space having a fuel-burning appliances.

6. Intake openings shall not be located closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.

7. Intake openings shall not be located where they will take air from an attic, crawl space, or garage.

403.8.4 Source specific ventilation requirements. Source specific exhaust ventilation systems shall exhaust at least the volume of air required for exhaust in Table 403.3. Exhaust shall be provided in each kitchen, bathroom, water closet, laundry area, indoor swimming pool, spa, and other room where water vapor or cooking odor is produced.

403.8.4.1 Source specific exhaust systems. Exhaust systems shall be designed and installed to meet all of the criteria below:

1. Source specific exhaust shall be discharged outdoors.
2. Exhaust outlets shall comply with Section 501.2.
3. Pressure equalization shall comply with Section 501.3.
4. Exhaust ducts in systems which are designed to operate intermittently shall be equipped with back-draft dampers.
5. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.
6. Terminal outlet elements shall have at least the equivalent net free area of the ductwork.
7. Terminal outlet elements shall be screened or otherwise protected as required by Section 501.2.2.

8. Exhaust fans in separate dwelling units or guest rooms shall not share common exhaust ducts unless the system is engineered for this operation.

9. Where permitted by Chapter 5, multiple source specific exhaust ducts may be combined. If more than one of the exhaust fans in a dwelling unit or guest room shares a common exhaust duct then each exhaust fan shall be equipped with a back-draft damper to prevent the recirculation of exhaust air from one room to another room via the exhaust ducting system.

403.8.4.2 Source specific exhaust fans. Exhaust fan construction and sizing shall meet the following criteria.

1. Exhaust fans shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure, HVI 916, HVI Airflow Test Procedure, and HVI 920, HVI Product Performance Certification Procedure).

EXCEPTION: Where a range hood or down draft exhaust fan is used for source specific exhaust for a kitchen, the device is not required to be rated per these standards.

2. Installation of the system or equipment shall be carried out in accordance with manufacturers' installation instructions.

3. Fan airflow rating and duct system shall be designed and installed to deliver at least the exhaust airflow required by Table 403.3. The airflows required refer to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measurement device.

- EXCEPTIONS:
1. An exhaust airflow rating at a pressure of 0.25 in. w.g. may be used, provided the duct sizing meets the prescriptive requirements of Table 403.8.4.2.
 2. Where a range hood or down draft exhaust fan is used to satisfy the source specific ventilation requirements for kitchens, the range hood or down draft exhaust shall not be less than 100 cfm at 0.10 in. w.g.

**Table 403.8.4.2
Prescriptive Exhaust Duct Sizing**

Fan Tested cfm at 0.25 inches w.g.	Minimum Flex Diameter	Maximum Length in Feet	Minimum Smooth Diameter	Maximum Length in Feet	Maximum Elbows ¹
50	4 inches	25	4 inches	70	3
50	5 inches	90	5 inches	100	3
50	6 inches	No Limit	6 inches	No Limit	3
80	4 inches ²	NA	4 inches	20	3
80	5 inches	15	5 inches	100	3
80	6 inches	90	6 inches	No Limit	3
100	5 inches ²	NA	5 inches	50	3
100	6 inches	45	6 inches	No Limit	3
125	6 inches	15	6 inches	No Limit	3
125	7 inches	70	7 inches	No Limit	3

1. For each additional elbow, subtract 10 feet from length.
 2. Flex ducts of this diameter are not permitted with fans of this size.

403.8.5 Whole house ventilation requirements. Each dwelling unit or guest room shall be equipped with one of the following four types of mechanical whole house ventilation systems: A system using exhaust fans (see Section 403.8.6);

a system integrated with forced-air systems (see Section 403.8.7); a system using supply fans (see Section 403.8.8); or a heat or energy recovery ventilation system (see Section 403.8.9).

403.8.5.1 Outdoor air. Outdoor air shall be distributed to each habitable space.

Where outdoor air supply intakes are separated from exhaust vents by doors, means shall be provided to ensure airflow to all separated habitable spaces by installing distribution ducts, installed grilles, transoms, doors undercut to a minimum of 1/2-inch above the surface of the finish floor covering, or other similar means where permitted by the International Building Code.

The mechanical system shall operate continuously to supply at least the volume of outdoor air required in Table 403.3 or Table 403.8.1.

EXCEPTION: Intermittently operating ventilation systems: The mechanical system shall have controls for intermittent operation per Section 403.8.2 and shall supply at least the volume of outdoor air required for intermittent operation based on the combination of its delivered capacity (from Table 403.3 or Table 403.8.1), its ventilation effectiveness (from Table 403.8.5.1) and its daily fractional operation time (from Table 403.8.5.1) using the formula:

$$Q_f = Q_r / (\epsilon f)$$

Where:

- Q_f = outdoor air flow rate
- Q_r = ventilation air requirement (from Table 403.3 or 403.8.1)
- ϵ = ventilation effectiveness (from Table 403.8.5.1)
- f = fractional operation time (from Table 403.8.5.1)

Table 403.8.5.1
Ventilation Effectiveness for Intermittent Fans

Daily Fractional Operation Time, f	Ventilation Effectiveness, ϵ
$f \leq 35\%$	0.33
$35\% \leq f < 60\%$	0.50
$60\% \leq f < 80\%$	0.75
$80\% \leq f$	1.0

403.8.5.2 Whole house supply system general requirements. Whole house ventilation systems integrated with a forced-air system, systems using supply fans and systems using a heat or energy recovery ventilation system shall comply with the following.

1. Outdoor air louvers shall be adequately sized for the required airflow and shall comply with Section 401.5. Outdoor air intake locations shall comply with mechanical air intakes requirements of Section 403.8.3.

2. Outdoor air ducts for dedicated or central supply systems and exhaust ducts for heat or energy recovery systems shall be provided with a means for balancing the system to the required airflow via balance dampers or other devices.

3. Outdoor air ducts, for dedicated or central systems shall be provided with motorized dampers.

EXCEPTION: Outdoor air ducts at heat or energy recovery ventilation systems are not required to have motorized dampers.

4. Ducts in the conditioned space shall be insulated to a minimum of R-4. In heat or energy recovery ventilation systems, ducts upstream of the heat exchanger shall also be insulated to at least R-4.

5. All outdoor air ducts shall be designed and installed to deliver at least the outdoor airflow required by Section 403.8.5.1. The airflows required refer to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measurement device.

EXCEPTION: The outdoor air duct for supply fan systems and heat or energy recovery systems may be prescriptively sized per Table 403.8.5.2 for dedicated outdoor air ducts upstream of the supply fan. Supply fans shall have the capacity to provide the amount of outdoor air required by Section 403.8.5.1 at 0.40 in. w.g. as per HVI 916 (April 1995). When prescriptively sized the system shall be tested and balanced using a flow hood, flow-grid, or other airflow measurement device.

6. Whole house ventilation controls for continuous and intermittent operation shall be provided at both the forced-air fan and the motorized damper.

Table 403.8.5.2
Prescriptive Supply Fan Duct Sizing

Supply Fan Tested cfm at 0.40" w.g.		
Specified Volume from Table 408.1	Minimum Smooth Duct Diameter	Minimum Flexible Duct Diameter
50 - 90 cfm	4 inch	5 inch
90 - 150 cfm	5 inch	6 inch
150 - 250 cfm	6 inch	7 inch
250 - 400 cfm	7 inch	8 inch

403.8.6 Whole house ventilation with exhaust fan systems. This section establishes minimum requirements for mechanical whole house ventilation systems using exhaust fans.

403.8.6.1 Outdoor air. Exhaust fan only ventilation systems shall provide outdoor air through one of the following methods:

1. Outdoor air may be drawn through air inlets installed in exterior walls or windows. For interior spaces without openings to the outdoor, air inlets cannot be used unless a transfer fan is provided in compliance with Section 403.8.6.1 Item 3. The air inlets shall comply with all of the following:

a. Inlets shall have controllable, secure openings and shall be designed to not compromise the thermal properties of the building envelope.

b. Inlets shall be accessible to occupants.

c. Inlets shall be screened or otherwise protected from entry by insects, leaves, or other material.

d. Inlets shall provide not less than 4 square inches of net free area of opening for each 10 cfm of outdoor air required in Table 403.3 or Table 403.8.1.

e. Any inlet or combination of inlets which provide 10 cfm at 10 Pascals as determined by the Home Ventilation Institute Air Flow Test Standard (HVI 901 (November 1996)) are deemed equivalent to 4 square inches of net free area.

f. Each occupiable space shall have a minimum of one air inlet that has a minimum of 4 square inches of net free area.

2. In high-rise buildings, outdoor air may be drawn in through operable windows, doors, louvers or other operable openings to the outdoors. Exterior spaces shall have a minimum openable area of 4 percent of the total floor area being ventilated. Doors exiting to a corridor, court or public way shall not be used to provide outdoor air. For interior spaces without openings to the outdoors, the opening to the adjoining room shall be unobstructed and shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet. The operable openings shall comply with the following:

a. Openings shall be controllable, securable, and shall be designed to not compromise the thermal properties of the building envelope.

b. Openings shall be accessible to occupants.

3. For interior spaces, in buildings with air inlets in accordance with Section 403.8.6.1 Item 1 or in high-rise building without operable openings in accordance with Section 403.8.6.1 Item 2 shall have a whole house transfer fan sized to provide a minimum of the ventilation rate required per Section 403.8.5.1. The transfer fan shall circulate air between the interior room or space and the adjacent habitable space. The transfer fan may operate continuously or intermittently using controls per Section 403.8.2.

403.8.6.2 Outside air intake locations. All outside air intake opening types described in Section 403.8.6.1 shall be classified operable openings and shall not be classified as mechanical air intakes. The intake locations shall comply with Section 403.8.3.

403.8.6.3 Whole house exhaust system. Whole house exhaust system shall be designed and installed to meet all of the applicable criteria below:

1. Whole house ventilation exhaust shall be discharged outdoors.

2. Exhaust outlets shall comply with Section 501.2.

3. Exhaust ducts in systems which are designed to operate intermittently shall be equipped with back-draft dampers.

4. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.5. Terminal outlet elements shall have at least the equivalent net free area of the ductwork.

5. Terminal outlet elements shall be screened or otherwise protected as required by Section 501.2.2.

6. One of the required source specific exhaust fans for the laundry room or bathroom may be designated as the whole house exhaust fan.

7. Exhaust fans in separate dwelling units or guest rooms shall not share common exhaust ducts unless the system is engineered for this operation.

8. Where permitted by Chapter 5 whole house exhaust ducts may be combined with other source specific exhaust ducts. If more than one of the exhaust fans in a dwelling unit or guest room shares a common exhaust duct then each exhaust fan shall be equipped with a back-draft damper to prevent the recirculation of exhaust air from one room to another room via the exhaust ducting system.

403.8.6.4 Whole house exhaust and transfer fans. Exhaust fan construction and sizing shall meet the following criteria.

1. Exhaust and transfer fans shall be tested and rated in accordance with the airflow and sound rating procedures of the Home Ventilating Institute (HVI 915, HVI Loudness Testing and Rating Procedure, HVI 916, HVI Airflow Test Procedure, and HVI 920, HVI Product Performance Certification Procedure).

2. Installation of system or equipment shall be carried out in accordance with manufacturers' design requirements and installation instructions.

3. Fan airflow rating and duct system shall be designed and installed to deliver at least the outdoor airflow required by Table 403.3 or Table 403.8.1. The airflows required refer to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measurement device.

EXCEPTION: An airflow rating at a pressure of 0.25 in. w.g. may be used, provided the duct sizing meets the prescriptive requirements of Table 403.8.5.2.

403.8.6.5 Fan noise. Whole house exhaust and transfer fans located 4 feet or less from the interior grille shall have a sound rating of 1.0 or less measured at 0.10 inches water gauge. Manufacturer's noise ratings shall be determined as per HVI 915. Remotely mounted fans shall be acoustically isolated from the structural elements of the building and from attached ductwork using insulated flexible duct or other approved material.

403.8.7 Whole house ventilation integrated with forced-air systems. This section establishes minimum requirements for mechanical whole house ventilation systems using forced-air system fans.

403.8.7.1 Outdoor air. Forced-air system fan ventilation systems shall provide outdoor air through one of the following methods:

1. A dedicated outdoor air louver and outdoor air duct for each dwelling unit or guest room shall supply outdoor air to the return side of the forced-air system fan; or

2. A central outdoor air delivery system that supplies multiple dwelling units or guest rooms shall supply outdoor air to the return side of the forced air system fan.

403.8.7.2 Whole house forced-air system. Where outdoor air is provided to each habitable dwelling unit or guest room by a forced-air system, the outdoor air duct shall be connected to the return air stream at a point within 4 feet upstream of the forced-air unit. It shall not be connected directly to the forced-air unit cabinet in order to prevent thermal shock to the heat exchanger. At a minimum, filtration of the outdoor air shall be provided at the forced-air unit. The filter shall be accessible for regular maintenance and replacement. The filter shall have a Minimum Efficiency Rating Value (MERV) of at least 6.

403.8.8 Whole house ventilation with supply fan systems. This section establishes minimum requirements for mechanical whole house ventilation systems using supply fan systems.

403.8.8.1 Outdoor air. Supply fan ventilation systems shall provide outdoor air through one of the following methods:

1. A dedicated outdoor air louver and outdoor air duct for each dwelling unit or guest room shall supply outdoor air to a supply fan; or

2. A central outdoor air supply fan system shall distribute unconditioned or conditioned air to multiple dwelling units or guest rooms.

403.8.8.2 Whole house supply system. Where outdoor air is provided to each habitable dwelling unit or guest room by supply fan systems the outdoor air shall be filtered.

The system filter may be located at the intake device or inline with the fan. The filter shall be accessible for regular maintenance and replacement. The filter shall have a Minimum Efficiency Rating Value (MERV) of at least 6.

403.8.9 Whole house ventilation with heat recovery or energy recovery ventilation systems. This section establishes minimum requirements for mechanical whole house ventilation systems using heat recovery or energy recovery ventilation systems.

403.8.9.1 Outdoor air. Heat recovery or energy recovery ventilation systems shall provide outdoor air through one of the following methods:

1. A dedicated outdoor air louver and outdoor air duct for each dwelling unit or guest room shall supply outdoor air to the heat recovery or energy recovery ventilator; or

2. A central outdoor air heat recovery or energy recovery unit shall distribute conditioned air to multiple dwelling units or guest rooms.

403.8.9.2 Whole house heat recovery ventilator system. Where outdoor air is provided to each habitable dwelling unit or guest room by heat recovery or energy recovery ventilator the outdoor air shall be filtered. The filter shall be located on the upstream side of the heat exchanger in both the intake and exhaust airstreams with a Minimum Efficiency Rating Value (MERV) of at least 6. The system filter may be located at the intake device or inline with the fan. The filter shall be accessible for regular maintenance and replacement.

403.8.10 Source specific exhaust ventilation and whole house ventilation alternate performance or design requirements. In lieu of complying with Sections 403.8.4 or 403.8.5 compliance with the section shall be demonstrated through engineering calculations by an engineer licensed to practice in the state of Washington or by performance testing. Documentation of calculations or performance test results shall be submitted to and approved by the building official. Performance testing shall be conducted in accordance with approved test methods.

403.8.11 Alternate systems. When approved by the code official, systems designed in accordance with ASHRAE Standard 62.2-2007 shall be permitted.

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency and appear in the Register pursuant to the requirements of RCW 34.08.040.

WSR 11-18-089
EXPEDITED RULES
BUILDING CODE COUNCIL

[Filed September 7, 2011, 9:05 a.m.]

Title of Rule and Other Identifying Information: Chapter 51-51 WAC, Washington state amendment of the 2009 International Residential Code.

NOTICE

THIS RULE IS BEING PROPOSED UNDER AN EXPEDITED RULE-MAKING PROCESS THAT WILL ELIMINATE THE NEED FOR THE AGENCY TO HOLD PUBLIC HEARINGS, PREPARE A SMALL BUSINESS ECONOMIC IMPACT STATEMENT, OR PROVIDE RESPONSES TO THE CRITERIA FOR A SIGNIFICANT LEGISLATIVE RULE. IF YOU OBJECT TO THIS USE OF THE EXPEDITED RULE-MAKING PROCESS, YOU MUST EXPRESS YOUR OBJECTIONS IN WRITING AND THEY MUST BE SENT TO Tim Nogler, Managing Director, Washington State Building Code Council, P.O. Box 41449, Olympia, WA 98504-1449, AND RECEIVED BY November 10, 2011.

Purpose of the Proposal and Its Anticipated Effects, Including Any Changes in Existing Rules: WAC 51-51-1508, this section contained several editorial errors that were carried over from the previous whole house ventilation method in the Ventilation and Indoor Air Quality Code. Various instances of the term "intermediate" were removed where they were not appropriate in the methodology adopted for the 2009 code. In addition, a new section was added as Section 1508.1.1 that consolidated requirements found scattered throughout the section to increase clarity. The other sections on controls and system operation were deleted. (OTS 4113.1)

Reasons Supporting Proposal: Some editorial errors were identified in the rules filed under WSR 10-03-098. This rule corrects those errors and makes other editorial reorganizations to make the section easier to use.

Statutory Authority for Adoption: RCW 19.27A.025, 19.27A.045.

Statute Being Implemented: Chapters 19.27, 19.27A, and 34.05 RCW.

Rule is not necessitated by federal law, federal or state court decision.

Name of Proponent: State building code council, governmental.

Name of Agency Personnel Responsible for Drafting and Implementation: Krista Braaksma, P.O. Box 41449, Olympia, WA 98504-1449, (360) 407-9278; and Enforcement: Local jurisdictions.

September 6, 2011

Kristyn Clayton
 Council Chair

AMENDATORY SECTION (Amending WSR 10-03-098, filed 1/20/10, effective 7/1/10)

WAC 51-51-1508 Section M1508—Whole house ventilation.

M1508.1 General. This section establishes minimum prescriptive design requirements for whole house ventilation systems. Each dwelling unit or guest room shall be equipped with a ventilation system complying with Section M1508.4, M1508.5, M1508.6 or M1508.7. Compliance is also permitted to be demonstrated through compliance with the International Mechanical Code.

M1508.1.1 (~~Operating Instructions. Installers shall provide the manufacturer's installation, operating instructions, and a whole house ventilation system operation description.~~)
Control and Operation.

1. Location of controls. Controls for all ventilation systems shall be readily accessible by the occupant.

2. Instructions. Operating instructions for whole house ventilation systems shall be provided to the occupant by the installer of the system.

3. Source specific ventilation systems. Source specific ventilation systems shall be controlled by manual switches, dehumidistats, timers, or other approved means.

4. Continuous whole house ventilation systems. Continuous whole house ventilation systems shall operate continuously. Exhaust fans, forced-air system fans, or supply fans shall be equipped with "fan on" as override controls. Controls shall be capable of operating the ventilation system without energizing other energy-consuming appliances. A label shall be affixed to the controls that reads "Whole House Ventilation (see operating instructions)."

5. Intermittent whole house ventilation systems. Intermittent whole house ventilation systems shall comply with the following:

5.1 They shall be capable of operating intermittently and continuously.

5.2 They shall have controls capable of operating the exhaust fans, forced-air system fans, or supply fans without energizing other energy-consuming appliances.

5.3 The ventilation rate shall be adjusted in accordance with Section M1508.3.

5.4 The system shall be designed so that it can operate automatically based on the type of control timer installed.

5.5 The intermittent mechanical ventilation system shall operate at least one hour out of every twelve.

5.6 The system shall have a manual control and automatic control, such as a 24-hour clock timer.

5.7 At the time of final inspection, the automatic control shall be set to operate the whole house fan according to the schedule used to calculate the whole house fan sizing.

5.8 A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

M1508.2 Continuously Operating Exhaust Ventilation Systems. Continuously operating exhaust ventilation systems shall provide the minimum flow rates specified in Table M1508.2.

TABLE M1508.2
MINIMUM VENTILATION RATES
 (Continuously operating systems)

	Bedrooms				
	0-1	2-3	4-5	6-7	>7
<1500	30	45	60	75	90

	Bedrooms				
	0-1	2-3	4-5	6-7	>7
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150
>7500	105	120	135	150	165

M1508.3 Intermittently Operating Ventilation Systems. The delivered ventilation rate for intermittently operating ventilation systems shall be the combination of its delivered capacity from Table M1508.2, and its ventilation effectiveness and daily fractional operation time from Table M1508.3.

$$Q_f = Q_r / (\epsilon f)$$

Where:

- Q_f = Fan flow rate
- Q_r = Ventilation air requirement (from Table M1508.2)
- ε = Ventilation effectiveness (from Table M1508.3)
- f = Fractional operation time

TABLE M1508.3
VENTILATION EFFECTIVENESS FOR INTERMITTENT FANS

Daily Fractional Operation Time, f	Ventilation Effectiveness, ε
f ≤ 35%	0.33
35% ≤ f < 60%	0.50
60% ≤ f < 80%	0.75
80% ≤ f	1.0

For systems designed to operate at least once every three hours, ventilation effectiveness can be 1.0.

M1508.4 ((~~Intermittent~~) Whole House Ventilation Using Exhaust Fans. This section establishes minimum prescriptive requirements for ((~~intermittent~~)) whole house ventilation systems using exhaust fans. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

M1508.4.1 Whole House Ventilation Fans. Exhaust fans providing whole house ventilation shall have a flow rating at 0.25 inches water gauge as specified in Table ((~~M1503.2~~ ~~{M1508.2}~~)) M1508.2 or M1508.3, as applicable. Manufacturers' fan flow ratings shall be determined according to HVI 916 (April 1995) or AMCA 210.

M1508.4.2 Fan Noise. Whole house fans located 4 feet or less from the interior grille shall have a sone rating of 1.0 or less measured at 0.1 inches water gauge. Manufacturer's noise ratings shall be determined as per HVI 915 (October 1995). Remotely mounted fans shall be acoustically isolated from the structural elements of the building and from

attached duct work using insulated flexible duct or other approved material.

M1508.4.3 (~~(Fan Controls. The whole house ventilation fan shall be controlled by a 24-hour clock timer with the capability of continuous operation, manual and automatic control. The 24-hour timer shall be readily accessible. The 24-hour timer shall be capable of operating the whole house ventilation fan without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house fan for at least 8 hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."~~)

M1508.4.4) Exhaust Ducts. All exhaust ducts shall terminate outside the building. Exhaust ducts shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.

~~(M1508.4.5)~~ **M1508.4.4 Outdoor Air Inlets.** Outdoor air shall be distributed to each habitable room by individual outdoor air inlets. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means. Doors shall be undercut to a minimum of 1/2 inch above the surface of the finish floor covering.

Individual room outdoor air inlets shall:

1. Have controllable and secure openings;
2. Be sleeved or otherwise designed so as not to compromise the thermal properties of the wall or window in which they are placed;
3. Provide not less than 4 square inches of net free area of opening for each habitable space. Any inlet or combination of inlets which provide 10 cfm at 10 Pascals as determined by the Home Ventilating Institute Air Flow Test Standard (HVI 901 November 1996) are deemed equivalent to 4 square inches net free area.

Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

1. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
2. Where it will pick up objectionable odors, fumes or flammable vapors.
3. A hazardous or unsanitary location.
4. A room or space having any fuel-burning appliances therein.
5. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
6. Attic, crawl spaces, or garages.

M1508.5 (~~(Intermittent)~~) **Whole House Ventilation Integrated With a Forced-Air System.** This section establishes minimum prescriptive requirements for (~~(intermittent)~~) whole house ventilation systems integrated with forced-air ventilation systems. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

M1508.5.1 Integrated Whole House Ventilation Systems. Integrated whole house ventilation systems shall provide outdoor air at the rate calculated using Section M1508.2 or M1508.3, as applicable. Integrated forced-air ventilation systems shall distribute outdoor air to each habitable room through the forced-air system ducts. Integrated forced-air ventilation systems shall have an outdoor air inlet duct connecting a terminal element on the outside of the building to the return air plenum of the forced-air system, at a point within 4 feet upstream of the air handler. The outdoor air inlet duct connection to the return air stream shall be located upstream of the forced-air system blower and shall not be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger. The system will be equipped with a motorized damper connected to the automatic ventilation control as specified in Section M1508.5.2. The required flow rate shall be verified by field testing with a flow hood or a flow measuring station.

~~M1508.5.2~~ (~~(Ventilation Controls. The whole house ventilation system shall be controlled by a 24-hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the forced air system blower and the automatic damper. The 24-hour timer shall be readily accessible. The 24-hour timer shall be capable of operating the whole house ventilation system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least 8 hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."~~)

~~M1508.5.3~~) **Ventilation Duct Insulation.** All supply ducts in the conditioned space shall be insulated to a minimum of R-4.

~~(M1508.5.4)~~ **M1508.5.3 Outdoor Air Inlets.** Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

1. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
2. Where it will pick up objectionable odors, fumes or flammable vapors.
3. A hazardous or unsanitary location.
4. A room or space having any fuel-burning appliances therein.
5. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
6. Attic, crawl spaces, or garages.

M1508.6 (~~(Intermittent)~~) **Whole House Ventilation Using a Supply Fan.** This section establishes minimum prescriptive requirements for (~~(intermittent)~~) whole house ventilation systems using an inline supply fan. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

M1508.6.1 Outdoor Air. Supply fan ventilation systems shall distribute outdoor air to each habitable room through the forced-air system ducts or through dedicated ducts to

each habitable room. Supply fans shall have the capacity to provide the amount of outdoor air specified in Table M1508.2 or M1508.3, as applicable, at 0.40 inches water gauge as per HVI 916 (April 1995). The outdoor air must be filtered before it is delivered to habitable rooms. The filter may be located at the intake device, in line with the fan, or, in the case of a connection to the return plenum of the air handler, using the furnace filter. An outdoor air inlet shall be connected to either the supply or return air stream.

M1508.6.2 Ducts. An outdoor air inlet duct connection to the supply air stream shall be located downstream of the forced-air system blower. An outdoor air inlet duct connection to the return air stream shall be located at least 4 feet upstream of the forced-air system blower and its filter. Neither type of duct shall be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger. The outdoor air inlet duct shall be prescriptively sized in accordance with Table M1508.6.2. The terminal element on the outside of the building shall be sized 2 inches in diameter larger than the outdoor air inlet duct.

TABLE M1508.6.2
PRESCRIPTIVE SUPPLY FAN DUCT SIZING

Supply Fan Tested cfm at 0.40" wg		
Specified Volume from Table M1508.2	Minimum Smooth Duct Diameter	Minimum Flexible Duct Diameter
50 - 90 cfm	4 inch	5 inch
90 - 150 cfm	5 inch	6 inch
150 - 250 cfm	6 inch	7 inch
250 - 400 cfm	7 inch	8 inch

M1508.6.3 Dampers. The system shall be equipped with a back-draft damper and one of the following:

1. A calibrated manual volume damper installed and set to meet the measured flow rates specified in Table ((M1508.2)) M1508.3 by field testing with a pressure gauge and/or following manufacturer's installation instructions; or
2. A manual volume damper installed and set to meet the measured flow rates specified in Table ((M1508.2)) M1508.3 by field testing with a flow hood or a flow measuring station; or
3. An automatic flow-regulating device sized to the specified flow rates in Table M1508.2 which provides constant flow over a pressure range of 0.20 to 0.60 inches water gauge.

~~**M1508.6.4 ((Ventilation Controls.** The whole house ventilation system shall be controlled by a 24-hour clock timer with the capability of continuous operation, manual and automatic control. This will control the inline supply fan. The 24-hour timer shall be readily accessible. The 24-hour timer shall be capable of operating the whole house ventilation system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least 8 hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."~~

~~**M1508.6.5)) Ventilation Duct Insulation.** All supply ducts in the conditioned space shall be insulated to a minimum of R-4.~~

~~**((M1508.6.6) M1508.6.5 Outdoor Air Inlets.** Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:~~

1. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
2. Where it will pick up objectionable odors, fumes or flammable vapors.
3. A hazardous or unsanitary location.
4. A room or space having any fuel-burning appliances therein.
5. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
6. Attic, crawl spaces, or garages.

M1508.7 ((Intermittent)) Whole House Ventilation Using a Heat Recovery Ventilation System. This section establishes minimum prescriptive requirements for ((intermittent)) whole house ventilation using a heat recovery ventilation system.

M1508.7.1 Heat Recovery Ventilation Systems. All duct work in heat recovery systems shall be sized and installed per the manufacturer's instructions. System minimum flow rating shall be not less than that specified in Table M1508.2 or M1508.3, as applicable. Heat recovery ventilation systems shall have a filter on the upstream side of the heat exchanger in both the intake and exhaust airstreams with a minimum efficiency ratings value (MERV) of 6.

~~**M1508.7.2 ((Ventilation Controls.** The whole house ventilation system shall be controlled by a 24-hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the inline supply fan. The 24-hour timer shall be readily accessible. The 24-hour timer shall be capable of operating the whole house ventilation system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least 8 hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."~~

~~**M1508.7.3)) Ventilation Duct Insulation.** All supply ducts in the conditioned space installed upstream of the heat exchanger shall be insulated to a minimum of R-4.~~

~~**((M1508.7.4) M1508.7.3 Outdoor Air Inlets.** Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:~~

1. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
2. Where it will pick up objectionable odors, fumes or flammable vapors.
3. A hazardous or unsanitary location.
4. A room or space having any fuel-burning appliances therein.

5. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.

6. Attic, crawl spaces, or garages.